SCIENTIFIC AMERICAN

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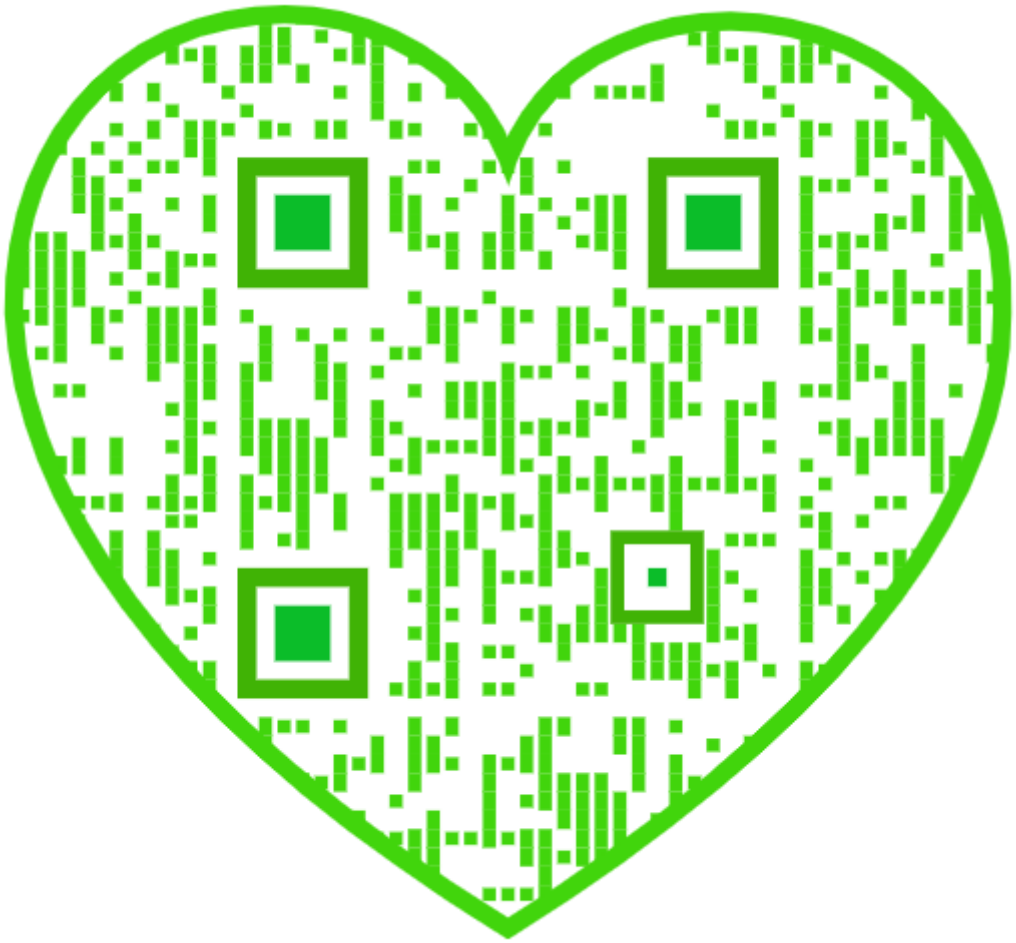
WILBUR WRIGHT FLYING OVER THE RACE TRACK AT LE MANS, FRANCE.—[See page 140.]



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NEW YORK, SATURDAY, AUGUST 29, 1908.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

IS THE MOTOR BUS PROFITABLE?

The development of the motor bus in the United States has been slow and its use is at present decidedly limited. In England, on the contrary, and particularly in the city of London, this type of conveyance has experienced a really phenomenal growth, both in numbers and the amount of traffic handled. The traffic conditions in London are particularly favorable to the development of this form of travel. The horse-drawn bus has for many decades been one of the most popular means of travel in that city, particularly for short distances; and when the motor bus entered the field, it found the traffic already developed on an enormous scale. Furthermore, it is stated that the English laws regulating the grant and the usage of franchises have been as favorable to the bus companies as they have been stringent in their application to steam and other railroads. Moreover, the best of mechanical skill has been applied to the perfecting of the motor bus. So successful, in point of numbers carried, have been the motor bus companies, that the various other lines of transportation, both surface and underground, have suffered severely from the competition. Nevertheless, according to recent dispatches, it would seem that in spite of the favorable auspices under which the motor bus traffic has been operated, most of the companies find that they are steadily losing money, the chief cause of loss being the high rate of depreciation of the engines and running gear—a drawback which in the early years of the development of the automobile made itself painfully felt to all owners that were not favored with a generous bank account.

PROPOSED TEST OF FULL-SIZED BLACKWELL'S ISLAND BRIDGE CHORD.

Capt. Eads, whose great arched bridge at St. Louis and whose valuable work in the control of the Mississippi River have won for him a distinguished place in the field of engineering, possessed in an eminent degree that distinctive quality of the truly great engineer, of being ready at any time to break completely away from tradition, even to the extent of adopting methods, apparently crude, to secure his results. The merit of his great bridge across the Mississippi lies in the fact that he had but little precedent to go upon, and that, when he flung these huge 520-foot steel arches across the river, he struck out on bold, original, and largely untried lines. He realized at once that the most vital part of any framed structure, subjected to great stress, is its compression members—a fact which our later engineers seem somehow to have forgotten, or whose importance, at least, they have ceased to realize. These compression members in the Eads bridge were of circular cross section, and built up of steel plates. Although Capt. Eads had designed them after a thorough study of the comparatively meager literature on the subject, he did not trust either to theory or the analogy of such existing structures as included large compression members, but determined that the only way to turn a seeming certainty into an assured fact was to take one of these full-sized sections and crush it to destruction in a testing machine. Unfortunately there was at that early day no testing plant that was of sufficient capacity to do the work; and because of the difficulty of putting up a machine that would provide abutments of sufficient reactive strength, it would have been a matter of great expense to build one of the usual type. Capt. Eads decided, therefore, to extemporize a testing plant, and he did so in a very simple, cheap, and highly efficient manner. He selected a stone quarry, in which were two opposed vertical walls, the distance between which was a few feet greater than the over-all length of his compression member. The latter was placed horizontally between the walls, and at one end a hydraulic cylinder of short length, but large diameter, was interposed between the member and the wall of the quarry. All that was then necessary was to attach a small hydraulic pump to the cylinder, and a gage to record the pressure. This very cheap and simple device worked admirably, and the exact crushing strength of the column was determined. It was suggested to the writer several months ago by former Bridge Commissioner Lindenthal, that a similar test of the much larger and stronger bottom chord of the Blackwell's Island Bridge could be made at a comparatively small expenditure of money, and the question of its safety, or otherwise, be at once put beyond all doubt. We now note that the suggestion has recently appeared over Mr. Lindenthal's signature in our esteemed contemporary Engineering News, and that the editor of that journal has given it his strong indorsement. At the present writing the strength of the bridge is under investigation by Prof. Burr. of Columbia University, on behalf of the City Bridge Department, and by Messrs. Boller & Hodge, who are acting under instructions from City Comptroller Metz, who declared some months ago that he would sanction no further payments upon the bridge until the question of its security had been amply demonstrated. Mr. Boller has assured us that, if his investigation leaves the question of the strength of the bottom chord in any doubt, he will recommend a test, either of a model built to scale, or of a full-sized member. We think that if any test be made, it should be of the full-sized piece, not only because of the greater certainty thereby obtained, but because such a test would afford a most valuable reference in the design of future long-span bridges. If the tests were carried out by the simple methods adopted in the case of the Eads bridge, the expense would be insignificant in comparison with the important interests involved.

THE PNEUMATIC TIRE AND THE HEAVY COMMERCIAL AUTOMOBILE.

In a paper recently read before the French Society of Civil Engineers the well-known tire expert, M. A. Michelin, offered some valuable suggestions on the proper design of tires for heavy commercial vehicles.

The pneumatic tire has hitherto been found useless for heavy weights, for two reasons: The largest pneumatic tire cannot safely carry more than fifteen hundred pounds and the pneumatic is inferior in economy, owing to a fact which many experiments have permitted M. Michelin to express in the following empirical law:

"The total travel of which a tire is capable is inversely proportional to the cube of the weight which it carries." For example: If the load is doubled the average wear and tear will be multiplied by eight, and an increase in weight of 5 per cent will cause an increase in wear and tear of 15 per cent.

So, every attempt to increase the load has been followed by such rapid wear of the tires that their employment had to be abandoned.

Hence, it has been found necessary to retain the solid rubber tire in order to lessen noise and soften shock; but India rubber, although very elastic and easily deformable, is almost incompressible, at least far less compressible than most solid bodies. This curious fact is not generally known. The solid rubber tire may be compared to a hollow tire filled with water, instead of air. It diminishes noise, but for deadening shock it is little more satisfactory than an iron tire. It permits, furthermore, only a slight increase in speed, so that some of the best constructors of heavy vehicles are now recommending the employment of iron tires together with speeds not exceeding 11 miles per hour. This limitation of speed is absolutely opposed to the chief object of the employment of the explosive motor. If there is to be no increase in speed, traction by horse power is far more economical.

At present the situation of the heavy weight vehicles is precisely the position occupied by the touring car before the adoption of pneumatic tires. The vibrations and shocks transmitted to the chassis and to all the mechanism rapidly wear out the motor and gearing. Of 162 vehicles possessed by the Paris Autobus Company, not more than 97 are ever in service at once, although the repair and maintenance shops employ a force of 200 mechanics. Yet the oldest of the vehicles has been in service only eighteen months.

The problem of tires for heavy vehicles is therefore still unsolved. To prove how unsatisfactory is the solid rubber tire, M. Michelin cites the following experiment: A wheel was caused to rotate with the tire velocity of 15½ miles an hour while carrying a load of 1,100 pounds, and furnished alternately with a pneumatic and a solid rubber tire 2½ inches thick, which was in contact with the broad tire of another and larger wheel upon which different small obstacles could be fastened. The displacements of the hub of the small wheel were inscribed in their true dimensions by a style upon a rotating cylinder. Vibrations amounting to ¼ inch for the solid, but only 1/50 inch for the pneumatic were recorded, even when no obstacle was present. These vibrations are caused by a slight eccentricity of the large wheel. They give an idea of the inferiority of a solid tire, which is confirmed by the passage of the wheel over obstacles. The first obstacle was a semi-cylinder about 4/5 inch high. This produced an elevation of the wheel amounting to 0.16 inch with the pneumatic and 0.40 inch with the solid tire. In other words the pneumatic absorbs four-fifths and the solid tire only one-half of the obstacle. The difference increases with the size of the obstacle. On an elongated block 4/5 inch high, the rise was 0.36 inch with the pneumatic and 1.16 inches with the solid tire. A semi-cylinder 1.2 inches in height caused the wheel to rise 0.28 inch with the pneumatic, and 1.04 inches with the solid tire. Finally, with an elongated obstacle 1.2 inches high, the wheel rose 0.44 inch with the pneumatic and 2.36 inches with the solid tire. In every case the ascent of the wheel, carrying a pneumatic tire, is less than the height of the obstacle; while with the solid tire the ascent is always greater than the height of the obstacle, unless this is very small. In endeavoring to repeat the experiment with the solid tires, the steel axles of the two wheels, whose diameters were 1.8 and 2.4 inches, became sprung. In order to avoid breakage the manufacturers of heavy automobiles have been obliged to reinforce their axles. M. Michelin states that he has seen axles made of I bars of forged steel of a height of 9 inches. For heavy-weight vehicles Michelin recommends the multiple pneumatic. It may consist, according to the weight which it has to carry, of two or more pneumatics, placed side by side upon the same wheel. For heavy vehicles, we are not concerned with high speed, and the construction must be adapted to give great strength in supporting loads. The envelope of the multiple tire, therefore, would not be suited for a touring car. It might be feared that two or more tires exposed together to the inequalities of the road would wear out almost as soon as a single tire, but this is not the case. Twin tires are found to last from three to seven times longer than single tires.

This is chiefly due to the law which we have already quoted, but there are other reasons. The twin tire suffers less from the brakes because their pressure is distributed over double the surface. Seventy-two experiments have proved that, at the same pressure, a pneumatic of small diameter absorbs obstacles better than one of large diameter.

ON COURTESY.

A large railway company, which every morning pours into New York thousands of suburban residents and in the evening carries them home again, has issued a set of five rules for the consideration of its agents and conductors—a semi-decalogue which constitutes an admirable code of manners and which may well be adopted not only by other railways, but by almost every public institution and business house. Conductors whose task it is to collect railway tickets usually assume an attitude which may best be described as restrained ferocity. Tickets are imperiously demanded, rarely asked for. When they are held out with rabbit-like submissiveness, they are snatched as if the passengers were reluctantly disgorging property stolen from the company. Starting with the principle that courtesy is a practical workaday application of the Biblical command to do unto others as you would they should do unto you, the little code of manners referred to points out that railroading is a highly complex and technical business, with every detail of which the employee of the road must be familiar, but of the intricacies of which the passenger has no conception. If in his bewilderment the patron of the road should seek enlightenment surely it is the duty of the employee to give politely and clearly whatever information may be asked. The manner of expression as well as the actual words used constitute an important element in the art of being polite. As the rules in question put it "a gracious manner . . . . is to your words what oil is to machinery in making them more effective to their purpose."

The suggestions here very briefly summarized may profitably be applied by every business man in his daily commercial life. The man who solicits your advertisement, the salesman who has samples to exhibit, the life insurance agent whose hair-trigger tongue pleads eloquently for your family, even the seductive canvasser who tries to inveigle you into buying a history of the world in twenty-five volumes, can be listened to for a courteous minute or two and politely dismissed without seriously clogging the wheels of business. Perhaps they may really have something worth while of offer. Above all, the tellers and the cashier

of every bank need a course in the art of gracious expression. Why should the depositor of money be regarded with frowning suspicion, and why should his mistake in indorsing checks wrong side up or his failure to have his books balanced regularly, call forth shouts of correction instead of a few words of kindly instruction? After all, he is only ignorant, or only forgetful. No dark scheme for defrauding the bank lurks behind his failure to follow the bank's rules. Courtesy is its own reward. It pays in personal satisfaction, in minimizing friction, in making friends, and in raising you in the eyes of your business associates.

THE SHACKLETON ANTARCTIC EXPEDITION.

BY JOHN PLUMMER.

The readiness with which the Australian government voted the sum of $25,000, and that of New Zealand an additional amount of $5,000, toward the expenses of the Antarctic expedition under Capt. Shackleton, illustrates the deep interest manifested throughout Australasia in everything connected with the solution of the mystery of the continent surrounding the Southern Pole. Australasian scientists have long given attention to the meteorological questions associated with the great Antarctic continent; and when it was proposed that Prof. David, who holds the chair of geology at Sydney University, and a couple of students should accompany the expedition, a general feeling of satisfaction was expressed.

The steam whaler "Endeavour" was to leave Lyttleton, New Zealand, on the first day of the present year, and after landing stores and all requirements for a year's stay on King Edward VII Land, return to New Zealand. Capt. Shackleton was a member of the expedition in 1901-4 under Capt. Scott, which reached the latitude of 82 deg. 17 min. south at longitude 163 deg. west. The explorers will remain about twelve months in the southland.

The distance from the proposed winter quarters of the expedition to the South Pole is about 730 miles, and of this about 270 miles as the crow flies has already been traversed. An automobile will draw a train of sledges the whole distance of 270 miles, when a number of Manchurian ponies will be employed. In the Scott expedition, ranges of high mountains were found in Victoria Land. They were situated about 82 deg. south, and reached from 10,000 feet to 12,000 feet in height. The coast line was traced due south as far as 83 deg. 20 min. Most of the traveling was accomplished on the great ice sheet floating on the sea front, and which was found to extend 100 miles from east to west, and 270 miles north and south, with a surface so flat and smooth that no change of level at the outer part could be detected by the aneroid. Further toward the shore the crumpling of icebergs and packs from the land created the customary array of hummocks and peaks, which make traveling both difficult and dangerous. Capt. Shackleton possesses the advantage of having his way clear up to within measurable distance of the South Pole, and of having the assistance of mechanical appliances unknown to previous explorers. Should no serious obstacles be encountered it is possible that the expedition will reach its destination within 35 days from the time of starting, traveling at the rate of 20 miles per day.

Prof. David will return in the "Endeavor" to New Zealand, and thence proceed to Sydney, but the limited time at his command will be well employed. Speaking to an interviewer, he said: "I will examine as far as possible, by landing here and there, the geological structure of the Antarctic regions, collect specimens, and obtain photographs; and I also hope to get some temperature and meteorological observations. Australia wants these latter particulars from the southern land urgently, for the Antarctic plays a most important part in the formation of her climate. It is indeed the great factor in controlling the weather conditions of Australia and New Zealand."

The Manchurian ponies which accompany the expedition possess considerable strength and powers of endurance. They number about twelve, and are provided with stalls on board the "Endeavour," but the space allowed for each is so limited that they will have to be on their feet during the whole of the voyage. As an additional precaution, it is proposed to drop a sledge load of provisions at each interval of a hundred miles during the overland journey, thus reducing the weight to be carried during the latter portion, and forming reserve supplies in case of accident during the work of return.

A subsidiary expedition is to leave New Zealand for the Auckland and Campbell Islands. The former are situated about 200 miles south of Stewart Island, the smallest and southernmost of the three islands forming the New Zealand dominion, and possessing an area of about 200,000 acres; the latter islands, embracing an area of 43,440 acres, being situated in latitude 52 deg. 33 min. south and longitude 169 deg. 8 min. west. Both groups, with a number of others, belong to New Zealand. This expedition will form a valuable adjunct to that under the command of Capt. Shackleton, the scientific data obtained being used in conjunction with that secured by the "Endeavour" party to assist in determining the actual relations of Australasia to Australia and New Zealand on the one hand, and to South America on the other. The party will be a somewhat large one, and include several of the leading Australasian magnetic observers, zoologists, botanists, geologists, and others. The whole of the observations will be conducted in a thoroughly systematic manner, and an effort will be made to obtain evidence bearing on the theory that in the past a vast continent existed in the south polar regions, uniting New Zealand to America in one direction, and to Australia, Kerguelen Land, Mauritius, Madagascar, Gerca, and the island of Tristan d' Acunha in the other.

THE WRIGHT AEROPLANE TESTS.

WILBUR WRIGHT'S LATEST FLIGHTS IN FRANCE.

On account of the small race track near Le Mans (670 x 2,600 feet), and also because the great crowd of spectators somewhat confused him, Wilbur Wright made arrangements to fly above the military field at Auvours, which is several miles in length by nearly a mile wide. After the broken plane had been repaired, his machine was towed by an automobile to this new practice ground. The transport of the aeroplane was effected expeditiously, the 7 miles being covered in three-quarters of an hour. After waiting several days before he was able to use the field, Mr. Wright at last, about 6 P. M. on August 21, was able to resume practice and to make two excellent flights of 1 minute 46 seconds and 2 minutes 18 seconds respectively. During these flights, which were made in a 7-mile wind, the aeroplane described a figure 8 and made other complicated curves at a height of from 10 to 50 feet above ground. These flights were witnessed by a great crowd despite the fact that the ground was much more inaccessible than the race track at Le Mans. Some German military men who witnessed them expressed great admiration of the machine and its aviator. When going with the wind in the second flight, Mr. Wright estimated that he attained a speed of practically 50 miles an hour, which was a greater speed than he had ever reached before. The machine worked satisfactorily, and it is probable that Mr. Wright will make the 31-mile flight called for within a very few days.

ORVILLE WRIGHT'S TESTS OF THE GOVERNMENT AEROPLANE.

The younger of the two Wright brothers, Mr. Orville Wright, arrived in Washington on the 21st instant, and, after inspecting the various parts of his aeroplane at Fort Myer, stated that it would require about ten days time in which to assemble the aeroplane and get it ready for the test flights. He has until September 28 in which to make the official speed and endurance trials, and, as the new machine has never been tried, he will doubtless proceed slowly and carefully, as his brother has done in France. The endurance test of 40 miles in an hour he expects to make above the parade ground at Fort Myer, but the speed test will probably be made over a straightaway 5-mile course across country.

RECENT MILITARY DIRIGIBLE BALLOONS.

THE BALDWIN AIRSHIP ACCEPTED.

After its preliminary trials to determine the speed, as detailed in our last issue, the committee which had charge of the testing of the Baldwin airship superintended the test for endurance on August 15. In the flight the previous day an average speed of 19.61 miles an hour was maintained. The requirements were that in the endurance flight the airship should maintain an average speed equal to 70 per cent of this and that it should fly continuously for two hours. The test was not started until 6:42 P. M. The same 4⅛-mile course from Fort Myer to Cherrydale, Va., and return was used as was followed the day before. The speed obtained was somewhat higher in one direction owing to a strong cross wind. The airship rounded the course seven times, and then flew about a mile out and back in order to complete the two-hour flight. It was in the air 2 hours, 1 minute, and 50 seconds, with the motor running continuously, and in this time it traversed a distance of nearly 28 miles. As it fulfilled all the conditions, it has been acquired by the War Department, and Captain Baldwin is at present engaged in instructing the officers of the Signal Corps in its management. A considerable number of short practice flights have already been made.

The dimensions of the new airship are 94 feet long, by 20 feet greatest diameter, its capacity being 19,500 cubic feet of gas. While it is by no means as large as the dirigibles of France, Germany, and England, it is nevertheless of sufficient size to carry two men with ease, and it is expected that it will serve a useful purpose in initiating the officers into the use of this type of air craft. In the endurance test, this new dirigible maintained an average speed of 13¾ miles an hour.

PRACTICE FLIGHTS OF THE NEW GERMAN MILITARY DIRIGIBLES.

During the past week the officers of the German army have been experimenting with the two new military dirigibles which Germany has recently had constructed—the "Parseval," and the "Gross II.," the latter of which is considerably smaller than the former. On August 14 the "Parseval" made a 2¾-hour flight, during which it circled completely around the city of Berlin. On August 17 it made two more ascents in the morning. The first was quite successful, but during the second the airship entered a cloud and the resulting contraction of the gas caused it to lose its shape and descend rapidly. It struck the ground so hard that one of the officers had his arm broken. The same evening at 10 P. M. the "Gross II." was taken from its shed and driven to Neustadt and return, a total air line distance of about 95 miles. It reached its starting point at Tegel at 3 A. M., so that, including the various maneuvers that were executed, it averaged about 20 miles an hour. On August 20 the two airships, with the Duke of Saxe-Altenbourg at the helm of the larger, maneuvered for two hours above Berlin. They traversed the Avenue of "Unter den Linden" at a slight elevation above the housetops, and so successfully did they perform different evolutions that the military authorities were greatly pleased. Since the excellent performances of these two new dirigibles, coupled to that of the ill-fated Zeppelin, Germany is now pressing France hard as regards the supremacy of the air from a military point of view.

SCIENCE NOTES.

"Neossin," the Chinese edible bird's nest, has been studied by E. V. McCollum, who finds that it is a glucoproteid. It gives Millon's, Adamkiewicz's, the biuret and xanthoproteic reactions. It contains 2 per cent of sulphur, 9.69 per cent of nitrogen and no phosphorus. Hausmann's method showed the nitrogen to be distributed as follows: NH_3, 1.3 per cent; humus, 1.27 per cent; phosphotungstic acid precipitate, 1.59 per cent; amino acids, 5.53 per cent. The substance is remarkable in that about one-fourth of its sulphur is liberated as SO_2 when the proteid is hydrolyzed with 3 per cent HCl. No sulphites are present in the nest. The gas was washed with $CuSO_4$ solution and gave no evidence of hydrogen sulphide. The mercaptan sulphur test is very faint. When boiled with 3 per cent HCl, the carbohydrate group is readily split off. The hydrolysis solution was precipitated with phosphotungstic acid and the filtrate used for the estimation of the sugar by Fehling's solution. It showed the presence of 15 per cent of sugar calculated as glucose in the sample. This solution gave an osazone which melts at 183 to 185 deg. C. and has the composition of a hexosazone. Arginine and histadine were identified in the phosphotungstic precipitate. Lysin appears to be absent.

The total oil output of the world may be taken as being about 20,000,000 tons per annum as against 800,000,000 of coal, and of this oil at best only one-third is available for fuel purposes. The crude oil as it comes from the well would be absolutely unfitted for use, as in most cases it gives off inflammable vapors at air temperatures, and these mingling with the air form highly explosive mixtures. The temperature at which such inflammable vapor is evolved is called the "flash point" of the oil, and for use in the British navy no oil with a flash point below 200 deg. F. is allowed on board, although in the German navy and the mercantile marine the limit is fixed at 150 deg. This necessary limitation means that the crude oil as it comes from the well has first to undergo a process of distillation, the more volatile portions yielding petroleum spirit or petrol, employed in motor cars, etc., while higher fractions flashing above 73 deg. F. form the lamp oil, used for illuminating purposes, and with most crude oils it is only the residue, which from American oil is called "residuum" and from Russian oil "ostatki," that fuel oil supplies can be drawn.

The annual report of the Astronomer Royal dealing with the work of the observatory during the past year contains an interesting paragraph on the method of illuminating the field of the transit circle. Sir W. H. M. Christie records the fact that it was discovered last year that the method of illuminating this field by means of an elliptical annular reflector, lit by an axis lamp, was open to objection, as the tilting of the reflector to different points to produce various degrees of illumination caused a shift in the center of light, and an apparent shift in the wires. A uniform central illumination has now been substituted, a small elliptical reflector with a matt white surface being cemented to the center of the object glass, reflecting the light of a small electric lamp: change in the degree of light is produced by altering the current through the lamp by a rheostat. This plan, says the report, has been in use in the altazimuth for a year with very satisfactory results. Arrangements have been made on each instrument to take a few transits by the old method for the purpose of comparison. A new arrangement of wires has also been inserted in the collimators of the transit circle, thin parallel wires replacing the thick oblique wires in former use.

WIRE SUSPENSION FOOT BRIDGE AT PLATT NATIONAL PARK.

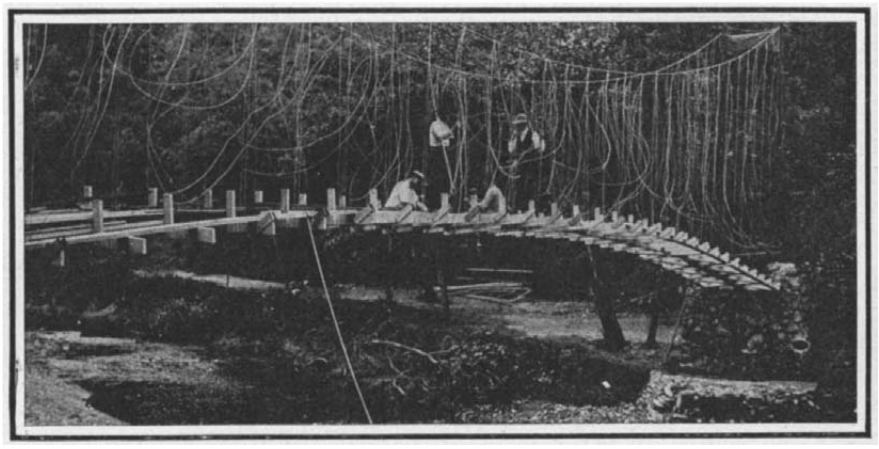
BY W. L. SALVAGE.

The accompanying cuts show the latest addition to the attractions of Platt National Park, Sulphur, Okla., in the form of a wire suspension foot bridge across Rock Creek, by which visitors have easy and safe access to the waters of its principal springs. The span is 112 feet, the width of roadway 3 feet in the clear, and the height above low water 24 feet. The towers consist of four 70-pound railroad rails each, set in concrete base and joined at the top by portal plates of boiler iron bolted through the flanges of the rails. These towers are set 3 feet in the concrete and have a net height of 27 feet to the top of the portal plate. Concave caps or "saddles" are fastened to the top of the towers to receive the supporting cables. The cables are ¾ inch Swedish iron with hemp center. The anchorage at the north end of the bridge, which is on a level with the floor, consists of a pit 5 x 12 feet and 7 feet in depth, at the bottom of which the cables are passed around 2-inch iron rods and secured by clips. This pit was filled with concrete of the proportions of 1-2-4 and was reinforced with a network of ½-inch iron rods at intervals of one foot, from bottom to top. The south anchorage consists of iron rods 1 inch in diameter and 6 feet in length, with welded eye to receive cable hook, threaded for 5 feet and supplied with six hexagonal nuts. These rods were set 6 feet into the solid rock of Bromide Cliff, the holes being filled with plastic cement mortar of the proportion of 1 to 2. At the north anchorage the cables are 9 feet apart at the surface, the distance to the top of the tower being 70 feet. At the south anchorage the cables are somewhat less, owing to the shorter distance to the fastenings. The width at the top of the towers is 6 feet. The width of the cables in the center of the bridge is 5 feet. Soldered to these cables at intervals of 3 feet are loops or "stirrups" of No. 8 galvanized wire, graduated in length from the ends to the center of the bridge so as to give a camber of 6 feet. Into these stirrups are placed floor beams 2 x 6 inches and 8 feet in length, upon which the superstructure of wood is supported. Drawn taut over the upper edges of these floor beams and fastened to iron rods in the concrete of the tower bases, are five No. 8 wires, placed as a precaution against an up-lift by the wind. Four planks, 2 x 8, with spaces of 2 inches, are laid lengthwise on the floor beams and upon these are three layers of inch floor boards, the first two layers placed at angles of 45 degrees and the last straight across, all layers having spaces for the free circulation of the air. The stringers are 2 x 8, dapped to 5 inches and strengthened by stays 2 x 4, 18 inches in length. On top of the stringers are the posts for the lattice, 2 x 4 and 36 inches in length. These are braced by 2 x 4 braces spiked to the end of the floor beams. On top of the lattice posts are caps 2 x 4 set on edge, on the top of which is the hand rail 2 x 6 with beveled edges. All dimensions are fastened by No. 40 spikes and all inch stuff by No. 10 nails. Lateral vibration is overcome by guy wires running from intervals of 28 feet on the bridge to anchorages on either bank of the stream. These and the supporting wires are adjusted by simply twisting them with an iron rod, care being taken to avoid kinks.

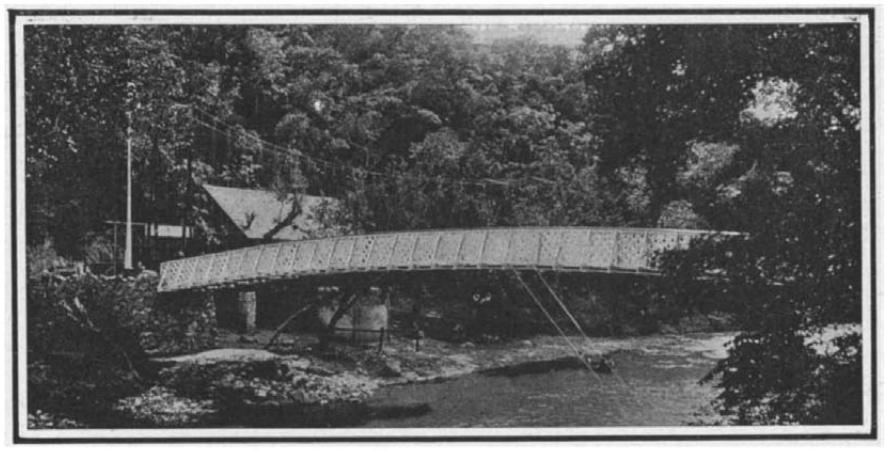
Total weight of bridge, 8,790 pounds. Bridge and twenty persons at 150 pounds each, 11,790 pounds. Safe strain on two cables, 64,000 pounds. Safe load on bridge, including the bridge itself, 11,860 pounds.

The bridge was designed by H. V. Hinkley, consulting engineer, Sulphur, Okla., and constructed by the government on force account, under the supervision of A. R. Greene, superintendent of Platt National Park. The estimated cost was $630, but the actual cost somewhat exceeded this amount.

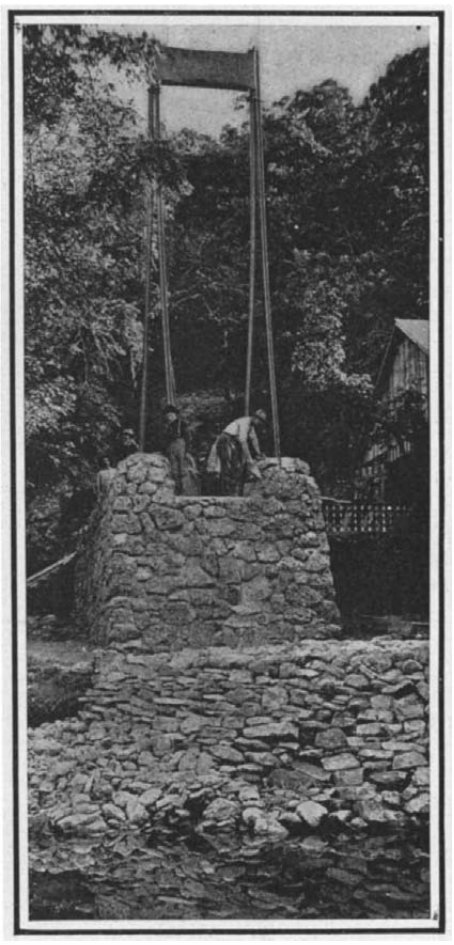
The Bridge as Viewed from the North Bank. Note the Steel Rail Towers.



Attaching the Wire Suspenders to the Framework of the Floor.



The Completed Suspension Foot Bridge across Rock Creek, Platt National Park.



The Towers Consist of Four 70-Pound Railroad Rails Set in a Concrete Base.

WIRE SUSPENSION FOOT BRIDGE AT PLATT NATIONAL PARK.

TESTING FOR HARDNESS.

BY J. F. SPRINGER.

What do we mean by the hardness of metals? A razor is hard—to that we all agree. And we say, thinking of such steel and of the diamond, that one thing is harder than another if it is capable of scratching it. This test has been in use for time out of mind, and if age is any guarantee of correctness, it ought to

(*Continued on page* 138.)

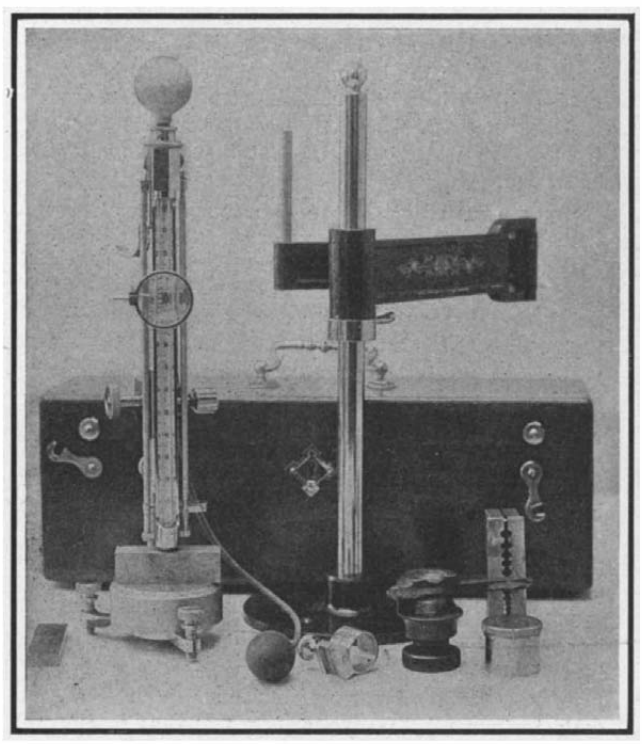


Fig. 1.—The Scleroscope, A New Instrument for Testing the Hardness of Metals.

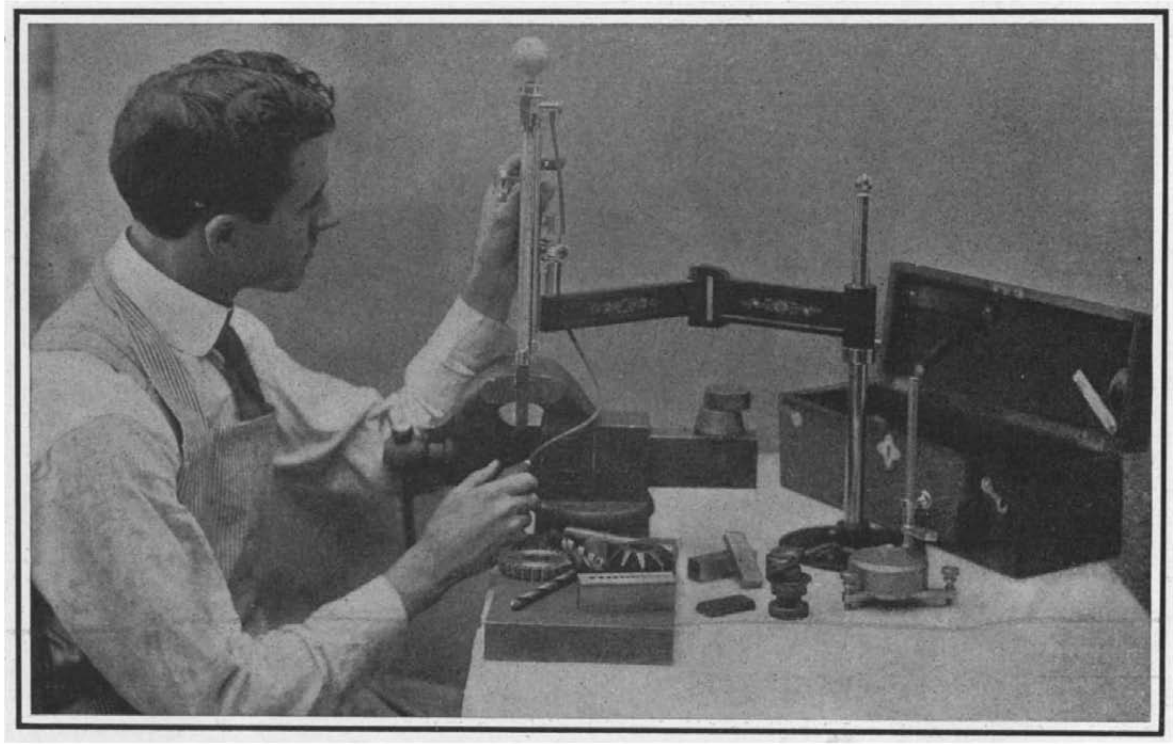


Fig. 2.—The Rebound of a Pointed Weight Dropped on the Specimen Registers the Instantaneous Resistance of the Latter to Deformation.

TESTING FOR HARDNESS.

A NEW TYPE OF CLAM-SHELL BUCKET.

Pictured in the accompanying engraving is a new type of clam-shell bucket that has been installed on the Cleveland & Pittsburg ore docks in the old river bed, Cleveland. The bucket has the enormously wide opening of 18 feet 1 inch inside measurement, which is obtained without increasing the height or complexity of the structure. The advantage of this reach in scraping or cleaning up is obvious. The bucket can be operated on any design of unloader using either steam or electricity. Its parts are few and durable and its cost of maintenance is low. The bucket shown in the illustrations has been in operation for over a month, requiring no further attention than lubrication.

Especially advantageous is this bucket in discharging the cargo from a 24-foot center boat with hatch openings running 12 feet fore and aft. It practically eliminates shoveling by hand. Another advantage, appreciated by operators, is in the position of the trays when the grab is open, as the digging edge of the trays comes in contact with the bulkhead or wing of the boat only, while the top of the trays is over 18 inches from either bulkhead, wing or stanch, thus taking the ore perfectly clean from any part of the vessel. When the grab is dropped the entire lower edge of the trays comes in contact with the tank top, obviating any damage to the tank top, which feature is greatly appreciated by vessel owners. The bucket will heel and reach to its full opening by simply placing the heavy scoop on only a half bucket of ore. Operators will appreciate the advantage of this in unloading ore from an adjoining hatch. For instance the operator by leaving some ore in the center of his hatch may lower the grab to the hold of the boat in the closed position and by placing either tray against the ore in the center of the hatch and opening the grab from this point will obtain a reach of 18 feet in either direction. Thus, if one rig should get out of order the two adjoining rigs could unload nearly all the ore from the 24-foot center boat without shifting either the rigs or the boat. The bucket is the invention of Mr. Huntsbery, of Cleveland, Ohio.

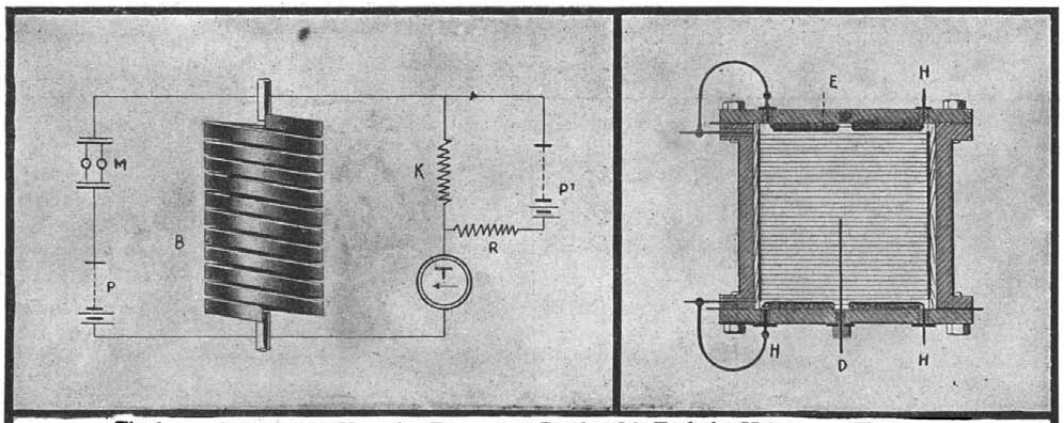
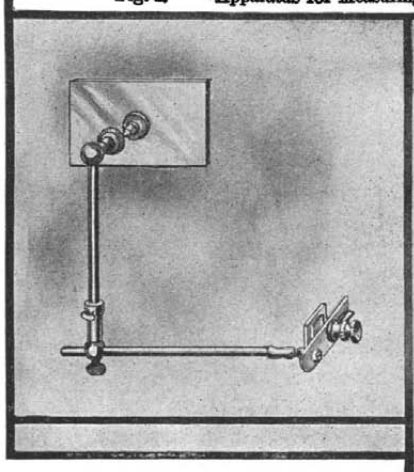
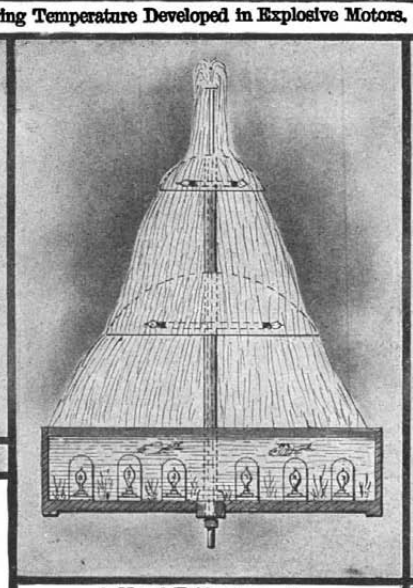


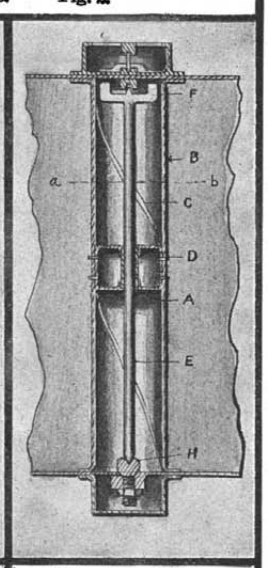
Fig. 1. Apparatus for Measuring Temperature Developed in Explosive Motors. Fig. 2.



A Reflector for Typists.



A Novel Table Decoration.



Magnetic Fuel Gage.

SOME INGENIOUS FOREIGN INVENTIONS.

There are European pioneers in many lines of invention who have always been successful in fashioning minor matters which make for usefulness or comfort. Several ingenious notions—as they might almost be termed—are illustrated in La Nature, from whose pages we abstract these descriptions.

SOME INGENIOUS FOREIGN INVENTIONS.

It is very difficult, in fact almost impossible, to determine the quantity of heat that escapes through the walls of the cylinders of explosion motors, as the calculations are based upon data (including the temperature produced by the explosion) which are yet very imperfectly known.

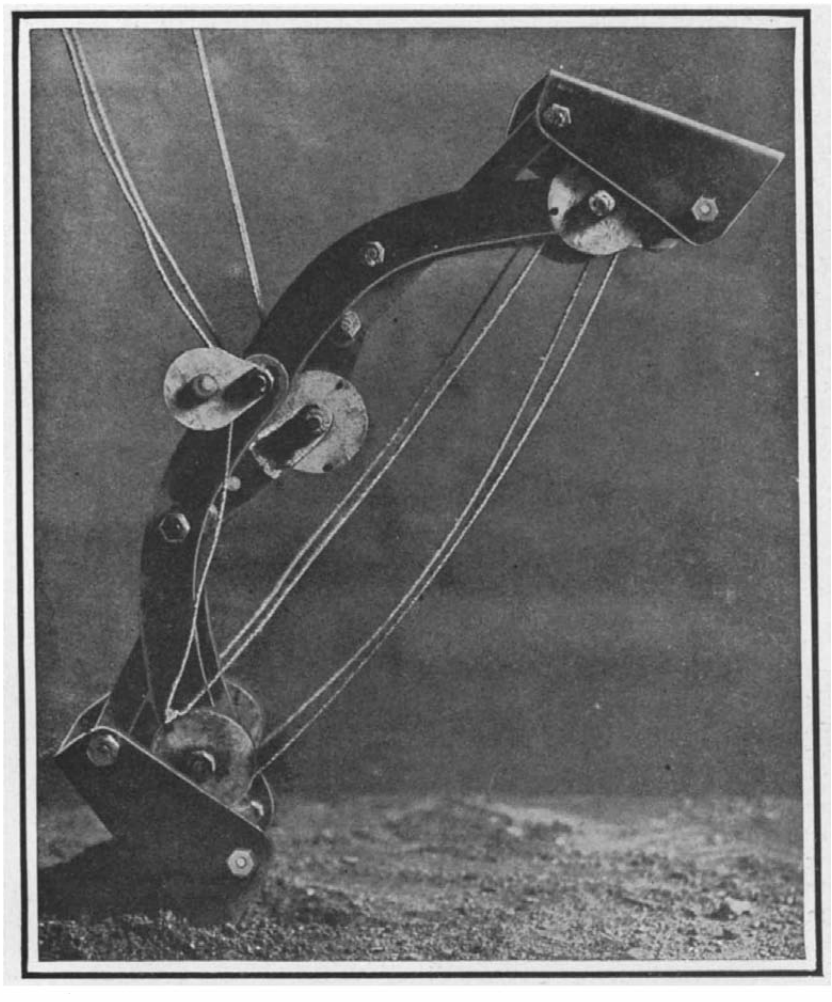
Prof. Hopkinson, of Cambridge University, who has devoted much attention to the theory of explosion motors, has invented a device by which this temperature can be measured directly. The apparatus is based upon the increase of the electrical resistance of copper with increase of temperature. It is a hollow vertical cylinder of cast iron, 12 inches in height and diameter. The interior is lined with wood and the top and bottom are covered with cork. The cylinder contains a ribbon of sheet copper, ¼ inch wide, wound in the form of a helix, with an air space 1/25 inch between the successive turns. The top and bottom of the cylinder are perforated in several places. The central hole in the bottom (*D*, Fig. 2) serves for the introduction of a candle of such length that the wick is at the center of the cylinder. Directly over the candle, in the center of the top, is an opening, *E*, by which the interior of the cylinder is put in communication with a self-registering pressure gage. The remaining apertures, *HHH*, serve for the introduction of strips of copper which are arranged in spirals on the top and bottom of the cylinder and which form one circuit with the central helix. In short, the apparatus constitutes an explosion chamber lined with strips of copper, through which a current can be passed before and during the explosions to furnish data for computing the rise in temperature from the change in resistance.

The cylinder having been filled with an explosive gaseous mixture and this ignited, the change in resistance is measured by means of the apparatus indicated in Fig. 1. The principal circuit comprises the cylinder coil *B*, a battery of fifty accumulators *P* and a group of lamps *M*. Connected as a shunt to the cylinder coil is a second circuit which includes a galvanometer *T* and a resistance of ¼ ohm *K*.

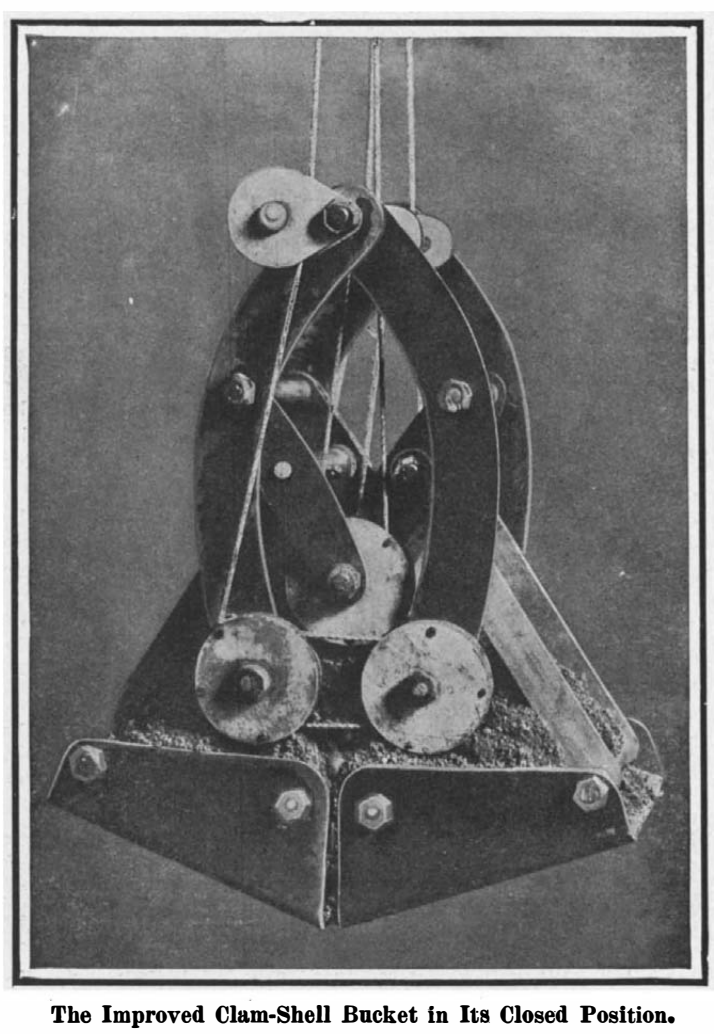
Finally, a third circuit, forming a shunt to the resistance *K*, includes a battery of six accumulators *P'* and a resistance *R*. This resistance and the lamp bank are so adjusted that a current of 8 amperes flows through the lamps and no current flows through the galvanometer *T*. The mixture is then exploded. The small increase of the resistance of the cylinder coil causes a proportionate increase in the difference of potential of its poles and a current through the galvanometer proportional to both of these changes. Hence the temperature produced by the explosion can be determined. The deflections of the galvanometer are recorded by a period of light which is reflected to a sheet of photographic paper by a mirror attached to the galvanometer needle. The pressure at each instant of the explosion is given by the pressure gage.

"Visible writing" typewriters are true to their name only when the light is good and they are advantageously placed with regard to it. In a room lighted by windows on one side only it is often difficult to read the writing on a cloudy day unless the machine faces, or nearly faces, the window, an arrangement which is not always convenient.

This defect is easily remedied by the "Philos," which is simply a small mirror, mounted on a jointed rod, which can be turned so as to reflect the light to the point where the key strikes the paper. The device is made in forms adapted to machines of various makes.



View Showing Enormous Opening of the Bucket, viz., 18 Feet 1 Inch.



The Improved Clam-Shell Bucket in Its Closed Position.

A NEW TYPE OF CLAM-SHELL BUCKET.

A pretty table decoration is easily constructed by anyone who has water and electricity "laid on" in his dining room. In a shallow tank with a wooden bottom and glass sides electric bulbs are mounted under glass globes which are hermetically joined to the bottom of the tank to protect the connections from water. The wires pass through the bottom of the tank, which is also traversed by three concentric tubes, two of which rise to a height of several feet, while the third and largest terminates below the edge of the tank and serves as an effiux pipe. The water enters through the smallest tube and its fall is broken into cascades by two or more flat domes of colored glass which are supported by the intermediate tube. Under these domes are arranged very small electric bulbs of various colors which are fed by wires which pass up the space between the two long tubes. The effect is heightened by placing shells and aquatic plants in the tank.

Automobilists often find it desirable to know the quantity of gasoline on hand at any instant in order to avoid exhausting the supply before reaching the goal and to know whether the speed should be increased or diminished. As the tank is lined with lead an ordinary gage rod can not be used and the glass tube employed in water gages is too fragile. A breakage during the race would be fatal and it is doubtful whether such a device would be accepted by the managers of the trials, who prefer a container of the simplest and most easily examined form and would probably object to the presence of the stuffing box joints which could be so contrived as to make the level of the liquid in the glass tube different from that in the body of the container and thus facilitate and conceal fraud.

The Bayard-Clement firm has devised a magnetic gage which is not open to these objections and indicates the level with great accuracy. It was first used at the recent Grand Prix. The container is traversed from top to bottom by a tube *B*, which bears spiral grooves on its inner surface. Inside the tube is a float *A*, furnished with pegs *D*, which engage in the grooves. The float, therefore, rotates as it descends, making one entire revolution in sinking from the top to the bottom of the tank. The rotation is communicated to a flat vertical rod *E*, which is placed in the axis of the tube and passes through the float. The rod is pivoted at top and bottom and bears at the top a horseshoe magnet *F*, the poles of which revolve with a very small clearance beneath the top of the tank, which is of non-magnetic metal. A magnetized needle mounted on a pivot above the top of the tank follows the rotary movement of the magnet and indicates on a graduated circle the azimuth of the latter. As the float turns with the magnet and sinks as it turns, descending from the top to the bottom of the tank in one revolution, the pointer thus indicates the height of the float and hence that of the liquid.

TESTING FOR HARDNESS.

(*Concluded from page* 136.)

be faultless. But of late years a new product in the form of an air-hardened manganese steel has come into use which product is capable of resisting the file and yet appears to be comparatively softer than the file. In fact, it seems possible that we have here another property of metals which comes to the aid of hardness proper in resisting the abrading action of the file. This property is toughness. Stopping to think, we see that it is quite possible with the slow-moving file that toughness comes in and obscures the test.

Now if this analysis be correct, hardness would appear to be the instantaneous capability of a metal to resist deformation. And differences in hardness we would define as the different degrees of resistant energy of various specimens when the elastic limit is exceeded.

If this description of hardness be correct, then the scleroscope invented by Mr. Albert F. Shore would seem to measure it exactly. The instrument consists essentially of a tiny weight pointed at one end, a piece of glass tubing, and a scale of measurements. The weight fits inside the tube, which serves as a guide. Upon holding the tube upright and allowing the weight to fall, pointed end downward, a sharp blow will be struck upon any specimen placed in position. A scale, graduated from 0 to 140, is placed behind the tube. Upon this scale, the rebound is measured. Referring to Fig. 1, the glass tube may readily be seen held in position by a standard on the left. The rod seen to the right of the tube swings freely from its upper end, and is, in fact, a plumb rod, employed for the purpose of enabling the operator to hold the instrument in a vertical position. The bulb seen at the top is used to exhaust the air from the tube and thus raise the weight. Once in position at the top of the tube the weight is detained by a suitable catch. When it is desired to operate the instrument, the finger hook seen on the left is pressed down and the bulb lying on the table is compressed. The weight is now released and free to fall.

The specimen to be tested should present a horizontal surface at the lower end of the tube. If it is of suitable size and shape it may be held in a clamp. If of irregular form, it may be imbedded in a composition of tar and asphaltum. This material affords in itself an illustration of hardness in reference to a quick blow. For it supports the specimen when subjected to the instantaneous impact with little or no yield, although the specimen may be imbedded in it with no trouble.

If the piece to be tested is large or if it is inconvenient to remove it from its position, the essential part of the instrument may be disengaged from its base, and used separately. This is a matter of great convenience. Thus, by opening a bearing box, both shaft and box may be tested. If the brasses are harder than the steel, it is a combination which may produce trouble; for should the bearing at any time become dry, the shaft would be cut.

By following out the line of procedure suggested by this illustration, a manufacturer will be able to assemble the parts of a machine on the principle of combining with a more expensive piece a softer, less expensive one, so that when wear takes place the less valuable part may be the one to suffer instead of the other. Likewise, the part removable at greater trouble may be associated with a softer and more easily removable piece. These principles are of great value in machine construction, and need only to be mentioned to be understood.

At present, two styles of hammer are used in the scleroscope—one with rather a sharp point, the other somewhat more blunted. The sharp-pointed weight strikes a blow of 75,000 pounds to the square inch. As the weight is quite small, it is necessary, in order to secure this result, that but a very minute area shall be in actual contact. Great difficulty was experienced in securing a material suited for such exacting service. The diamond was tried, but failed. Finally, using the scarcely perfected instrument itself in the effort for success, a method of treating steel was devised which enables the manufacturer to produce a weight capable of withstanding such a tremendous shock upon a very small point. When this hammer, after falling freely for about ten inches, strikes the surface of a fine grade of hardened steel, it rebounds about seven inches. As the scale is divided into 140 parts, such steel registers about 100 points. This rebound is sufficient to enable a distinction to be made between steels differing but slightly in hardness. Thus the fine grades of hardened pure carbon tool-steel range from 90 to 110 points. The same steels, unhardened, disclose a hardness of 40 to 50 points, if unannealed. If annealed properly, the hardness drops to about 31 points. Now the lower carbon steel (as railway rails) annealed show a hardness of about 26 to 30. Brass may be as hard as 30 or it may fall as low as 12. Wrought iron has been found to be 18 hard, while zinc and copper but 8 and 6, respectively. Turning to the alloy-steels, we find manganese self-hardening steel showing a hardness of 60 to 85. High-speed tool-steel, hardened, discloses an instantaneous resistance equal to 100 to 105. This seems to indicate that the finest pure carbon tool steel may be made harder than the alloy steel. But there are so many varieties and grades, and variations in handling, that we must not regard these figures as settling once for all the comparative hardness of these two important kinds of tool steel.

An interesting matter is the effect of compression. This seems, almost without exception, to increase the hardness of the metal. Thus wrought iron increases from 18 when in ordinary condition to 30 when compressed. Lead, which is, of course, very far down in the scale, varies from 2, uncompressed, to 3, compressed. But zinc shows the remarkable variation from 8 to 20—150 per cent increase. Hard brass, 30, may be made still harder by compressing its particles.

This new method of testing comes into direct competition with the Brinell method. The latter proceeds by the slow pressure of a ball upon the surface to be tested. The amount of permanent compression is taken as indicating the lack of hardness—or, expressed differently, as indicating by its reciprocal the degree of hardness. Thus, the deeper the permanent indentation, other things being equal, the softer the metal. It is to be noticed particularly, that it is not the original deformation that is relied on, but the permanent one. These matters of slowness and permanency would appear to be mutually corrective. Thus, by slow compression we should effect a deeper indentation. But, as recovery is allowed, and only the permanent indentation measured, the deformation would have a tendency to recover. At any rate, the Brinell method has proved itself of advantage during a considerable period of trial, and the new method would appear to correspond well with it; for comparative tests have been made, disclosing for the most part a rather striking agreement between the ball method and the drop-hammer procedure. Moreover, the scleroscope would seem to possess a very desirable property in the readiness with which it may be applied.

The Price of Sugar in Olden Times.

Cane sugar was produced by the Chinese at a very remote epoch. In western countries it was a more recent introduction. The Roman writers Pliny, Varro, and Lucian, at the beginning of our era, barely mentioned it. It was then known by the name of Indian salt and honey of Asia, Arabia, or India. In 1090, Crusaders arriving in Syria discovered sugar cane, which became a favorite dainty of the soldiers. During the following centuries the sugar cane was introduced into Cyprus, the Nile Delta, the north coast of Africa as far as Gibraltar, Sicily, and the kingdom of Naples. It reached Spain in the fifteenth century and thence was carried to Madeira and the Canaries. In 1644 the French imported it into Guadeloupe and a little later into Martinique and Louisiana. The Portuguese introduced it into Brazil and the English into Jamaica.

According to the Rivista Scientifico-Industriale, a hundredweight of sugar cost the following amounts in London and Paris, from the middle of the thirteenth to the end of the nineteenth century:

Date.	London.	Paris.
1260	1,031 francs = $206	....
1300	1,250 " = 250	....
1350	837 " = 167	....
1372	....	2,845 francs = $569
1400	1,156 " = 231	....
1426	....	1,441 " = 288
1450	1,500 " = 300	....
1482	....	1,375 " = 275
1500	267 " = 53	....
1542	....	340 " = 68
1550	458 " = 92	....
1598	....	534 " = 107
1600	397 " = 79	....
1650	402 " = 80	....
1700	266 " = 53	....
1750	103 " = 20	....
1800	191 " = 38	....

In regard to the price of transportation, in 1550 it cost 10 francs, or nearly $2, to send 250 kilogrammes or about 553 pounds of sugar from Antwerp to London, and 24 francs to send 50 kilogrammes by sea from Venice to Antwerp. It is well known that the discovery of the saccharine principle of beet root was made by Olivier de Serres, the gardener of Henri IV, in 1605. The first beet sugar factory was established in 1795, near Berlin, by Achard. In France, at the time of the continental blockade, the increase in price of sugar to 6 francs or $1.20 per pound proved a powerful stimulant to the establishment of beet-sugar factories. On January 2, 1812, Benjamin Delessert, a Paris sugar refiner, presented for the first time specimens of indigenous sugar to Chaptal and declared that the manufacture of beet sugar was in actual operation at Passy.

An Electric Moth Trap.

The Saxony authorities have discovered what would seem to be an excellent way to put an end to the caterpillar plague which is having such a disastrous effect on the local forests. They have discovered a method to catch the brown nun moths that lay the eggs from which the caterpillars come in enormous quantities. They make use of what they call the electric light trap. This consists of two large and powerful reflectors placed over a deep receptacle and powerful exhaust fans. The whole has been erected on top of the municipal electric plant at Zittau. At night two great streams of light are thrown from the reflectors on the wooded mountain sides half a mile distant.

According to the Electrical Review the results have been astonishing. The moths, drawn by the brilliancy, come fluttering in thousands along the broad rays of light: When they get to a certain distance from the reflectors the exhaust fans take up their work and with powerful currents of air swirl them down into the receptacle. On the first night no less than three tons of moths were caught. It has been decided to build another trap on the Rathaus Tower, and the fight with the moths will be continued.

The forests of central Europe have, from time to time, been ravaged by raids of moths from Russia, whose larvæ denude the trees of their foliage. The splendid pines of the Lausitz Mountains are this year threatened with destruction.

Another section of the through railway line from Keelung to Takow was opened to traffic on February 20, 1908. This is the section from Sansaho to Korisho, a distance of nine miles, which has involved some very heavy tunneling and bridging work. There are eight tunnels and three rivers have to be crossed, including the river bed of the Daiankei, which is crossed by a bridge 1,600 feet long and supported by eight spans. Only about four miles of the permanent way remains to be opened, and this, it is expected, will take place this year (1908). Meanwhile the journey from the capital to Tainan has been reduced to 12 hours 13 minutes, the distance being 200 miles.

"Sky Glows."

"Sky glows," termed by some of the European astronomers as aurora displays, are now the subject of interesting discussion in astronomical circles, especially among the scientists of Europe.

These phenomena were first observed about July 1 at Copenhagen, Könisberg, Berlin, Vienna, and other places. Mr. W. F. Denning, the English astronomer, says: "Certain features of the glows struck me as being essentially different from exhibitions of normal auroræ boreales. No streamers whatever were seen. Clouds observed were of peculiar character, and some of them showed traces of spiral formation. Though thin, they were strongly illuminative, and stars shone through them with surprising distinctness."

This feature of the phenomenon was seen in the eastern section of the United States following the break in the protracted heated drought which has prevailed in the Eastern, Middle, and South Atlantic States.

For some time a peculiar strong orange-yellow light over the horizon, the color of which was more orange in its lower parts and more yellow in its higher parts, has been observed all over northern Europe and the United States. Clouds or spiral streams of various tints were brilliantly outlined across the sky, so luminous that few stars could be seen, and the Milky Way was hardly distinguishable.

Mr. Brauner, of the Bohemian University, and Mr. Denning both say they saw no trace of the characteristic auroral bands or columns in this phenomenon. Mr. Denning says: "Whatever the true nature of the recent exhibition may have been, it is certain that something in the air exercised the capacity of reflection in a very high degree. The period was one of great heat and thunder storms."

An interesting feature of the phenomenon was that a high barometric maximum was lying in the north, and the winds were from that direction during the time of the nocturnal glows.

Accompanying these glows at night there were solar halos daily, which through telescopic observation showed, in the features of the atmospheric distortion of the sun's limb, the existence of two distinct drifts of the atmosphere.

The Current Supplement.

The current SUPPLEMENT, No. 1704, describes an up-to-date German fire-brigade station. All the vehicles described are automobiles. Prof. Silvanus Thompson gives a brief history of electric motive power. Because of their cheapness, the supply of matches amounts, for the whole world, to about two thousand million, an output made possible only by the almost total elimination of hand labor from their manufacture. Almost every operation from the sawing of the log to the filling and labeling of the boxes is performed by ingenious machines. The character of these machines and the method of their operation is described by O. Bechstein. The first of a series of articles on galvanizing is published. The English correspondent of the SCIENTIFIC AMERICAN gives an interesting biography of the famous physicist, Lord Rayleigh. A Roman sculptor has made a reconstruction of Imperial Rome, pictures of which are published. Prof. E. A. Birge concludes his article on the respiration of an inland lake. A soft coal fire is the subject of an article by the well-known engineer, Prof. Vivian B. Lewes, in which he describes the chemical processes of soft coal combustion. The transformation of heat into work is graphically described by Sidney A. Reeve. In all the fields of botanical research there is no more interesting subject than fungi. This subject is interestingly discussed by Sanford Omensetter.

"Lusitania" Breaks all Records.

The Cunarder "Lusitania" has added to her glory by beating her former short course record from Daunt's Rock, outside Queenstown, to Sandy Hook lightship by 3 hours and 40 minutes. Her new time between the starting and finishing lines of the course is, adding five hours for the difference between our own and the British clock, 4 days and 15 hours. Her best previous performance, also over the short northern course, which was completed on November 2 last, was 4 days 18 hours and 40 minutes.

On her best day's run, on the nautical day ending at noon on Monday, when she covered 650 nautical miles in 25 hours and 20 minutes, her average speed was 25.66 knots.

The readiness of Japan and China in adapting themselves to western methods of electrification, says the Railway News, is to-day amply evidenced in the work going on in the large cities of these two countries. Yokohama has its electric tramways. Tokio, the capital of Japan, has a fine system of electric railways. The railway engineers and directors are Japanese. Shanghai has recently completed a splendid system of tramways. Hongkong has operated street railways for several years with good results. There are many other cities in Japan and China which will undoubtedly follow the above-named cities and employ electricity.

Correspondence.

A Real "Human Ostrich."

To the Editor of the SCIENTIFIC AMERICAN:

While the writer was in the office of Drs. Gale and Bartle, of North Bend, Ore., who are the best surgeons here, a man called for treatment and complained of a severe pain in the lower region of the stomach. He was examined, sent at once to the Catholic Hospital, and operated on at 2 that afternoon. I inclose herewith a full list of articles found in his stomach, also photo which I had taken on the spot.

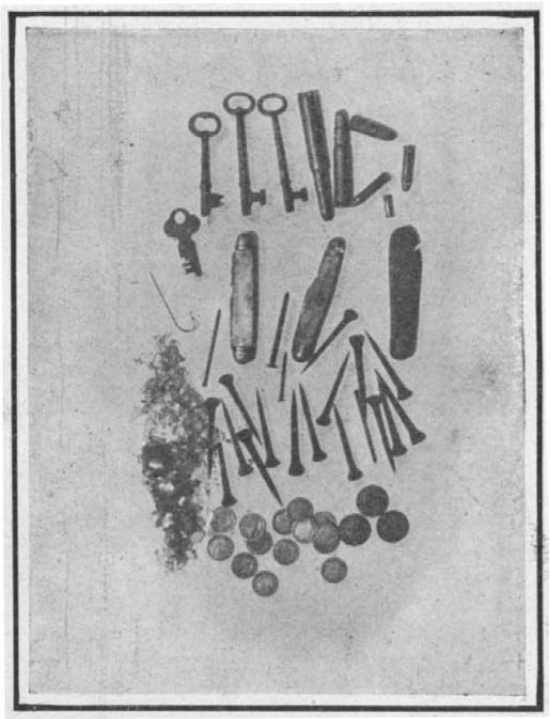
Drs. Gale and Bartle, also Father Curley and nurses were present. In sending the inclosed data, I do so that you may use same if you see fit. The man is alive and nearly well, and feels much improved.

The data I send are all true to the letter and will appear in leading medical journals.

Bandon, Ore, July 8, 1908. FREDERICK GRAHAM.

Owing to the fact that to the public it sounds like a fairy tale or a huge joke, I hereby give you a few facts about the operation on Frank Durga at the Mercy Hospital June 30, 1908.

Durga was born in Hillsdale, Mich., in 1853. Twenty-four years ago he found some glass and nails in a beef stomach and reasoned that if a beef could live after eating such things, he could. Hence his freak appetite began. He followed circuses, etc., for years, eating glass, nails, and other small articles. He traveled extensively and has been all over the United States, but never in Hawaii, as stated in another paper, and has been in this locality one year. He came under our observation about three months ago, and was suffering from severe cramps after having



AN AMAZING COLLECTION OF ARTICLES TAKEN FROM THE STOMACH OF A MAN.

eaten two electric light bulbs. Since that time he has had repeated attacks of cramps and finally entered the Mercy Hospital on June 22 and was operated on June 30, 1908. On reaching the stomach, this large mass was easily located, dragging the stomach far below its normal position and forming a pouch which rendered it impossible for any of this mass to reach the pylorus and be evacuated.

We removed 5 rifle balls, 3 jack-knives, 4 door keys, 17 horseshoe nails, 4 6-penny nails, 1 fish hook, 1 end from jointed rod, 1 plate from jack-knife handle, 15 dimes, 3 nickels, and 4 ounces of glass. Weight, 1 pound 14 ounces. The operation occupied fifty-five minutes.

The patient is now on liquid diet and is recovering. These are absolutely facts and can be vouched for by the hospital authorities here. DRS. GALE and BARTLE.

North Bend, Ore.

According to a contemporary, a new dyke to protect the double-track trestle of the "North Incline" of the Southern Railway, over which cars are run on to the car ferry on the Illinois side of the Mississippi River near St. Louis, has recently been completed. Floods had cut into the principal dyke protecting the trestle from high water, and had finally attacked the trestle itself. In making repairs a new dyke was added at right angles to the channel. An excavation was made about 5 feet deep and 50 feet wide; willow mattresses, closely woven and wired, were laid in the trench and covered with limestone riprap, which amounted to 1½ cubic yards for each 100 square feet of mattress. The up-stream side of the mattress was dipped about 2 feet, and heavily riprapped at the toe to prevent underscour. Piling was then driven through the mattress about 20 feet from the up-stream edge.

Employment of Sulphurous Acid in Sugar Refining.

In recent years pulverized zinc and aluminium, various sulphides and, in particular, sulphurous acid have been substituted for the lime, blood and bone black which were formerly used for purifying the crude sap of the sugar beet. The chemical purifying agents possess the advantages of being more active and of uniform strength, so that they can be employed with certainty of effect.

Fouquet and Weisberg have recently described a method of purifying saccharine liquids with sulphur dioxide or anhydrous sulphurous acid. This gas may be made directly by burning sulphur in specially contained furnaces or obtained from the cylinders in which it is sold in a compressed and liquid form. The gas is allowed to bubble through the sap, syrup or molasses until it exactly corrects the alkalinity which has been produced by a previous addition of lime. The process is controlled by drawing off measured quantities of the liquid and adding to them, from a burette, a standard acid solution until the liquid ceases to redden a solution of phenol-phthalein. The quantity of acid added gives the relative alkalinity of the saccharine liquid.

As sulphurous acid has a very energetic decoloring action only a small quantity is required and the cost of the operation is only a cent or two per ton of beet root. The minute quantity of calcium sulphite which is formed remains in the molasses and not a trace of it is found in the refined sugar. It should be observed in this connection that common sugar is one of the purest articles of commerce. Prof. Pellat, requiring a specimen of absolutely pure sugar in order to establish a method of analysis for the use of the government in fixing the tax on sugar, applied, not to his colleague, the professor of chemistry in the Sorbonne, but to the Say sugar refinery. All (French) white sugar, whether it is purchased in the form of loaves, cubes or crystals, is, to all intents and purposes, absolutely pure.

Color Museums Demanded.

A novel suggestion was put forward at the recent international art congress at the Victoria and Albert Museum by Mr. Alexander Millar, a prominent manufacturer and designer, who urged the need for systematic color training and recommended the establishment of "color museums." This idea, he explained, had received sympathetic support from many great artists. In every educational center and in every school there should be collections of objects selected for their beauty of color alone. There should be analytic color sections, showing the color scheme apart from the accidents of form and shadow.

The collection, continued Mr. Millar, need not be very costly. Why should not a beginning be made by making a selection from the beautifully colored textiles which appear from time to time in shop windows? The expense would be very small. Year by year beautiful stuffs are being produced and allowed to drop into oblivion. If such a collection be not formed now it might be that one hundred years hence our museum authorities will buy at a fancy price a collection of imperfect fragments of the very stuffs which could be now acquired for a nominal sum.

He spoke of what he knew when he said that such a collection would be heartily welcomed by all designers and by every one concerned with arts and industries in which color played an important part.—London Daily Graphic.

Consul Walter C. Hamm, at Hull, sends the following summary of motor accidents and prosecutions occurring in Great Britain in April of this year and compares it with April of 1907. It will be seen that in every instance but one there has been a large increase, the figures for the same month in the respective years being as follows:

	1908.	1907.
Accidents	79	58
Persons killed	25	16
Persons injured	49	28
Motorists summoned	310	158
Motorists convicted	291	141
Motorists convicted for driving dangerously, etc.	54	54
Motorists convicted for exceeding the speed limit	218	74
Motorists convicted for other offenses	19	13

In six of the fatal accidents the motorists were blamed, while of the other accidents, in seven cases the injured persons were subsequently awarded damages, and in ten cases the drivers were fined. There were four more instances of cars running away after causing accidents. The British public is becoming concerned over the increasing number of these accidents. It is probable that stricter laws governing the running of motor cars will be passed in the near future, intended to lessen, if not entirely prevent, such accidents.

GASOLINE-PROPELLED GUNBOATS FOR RIVER SERVICE.

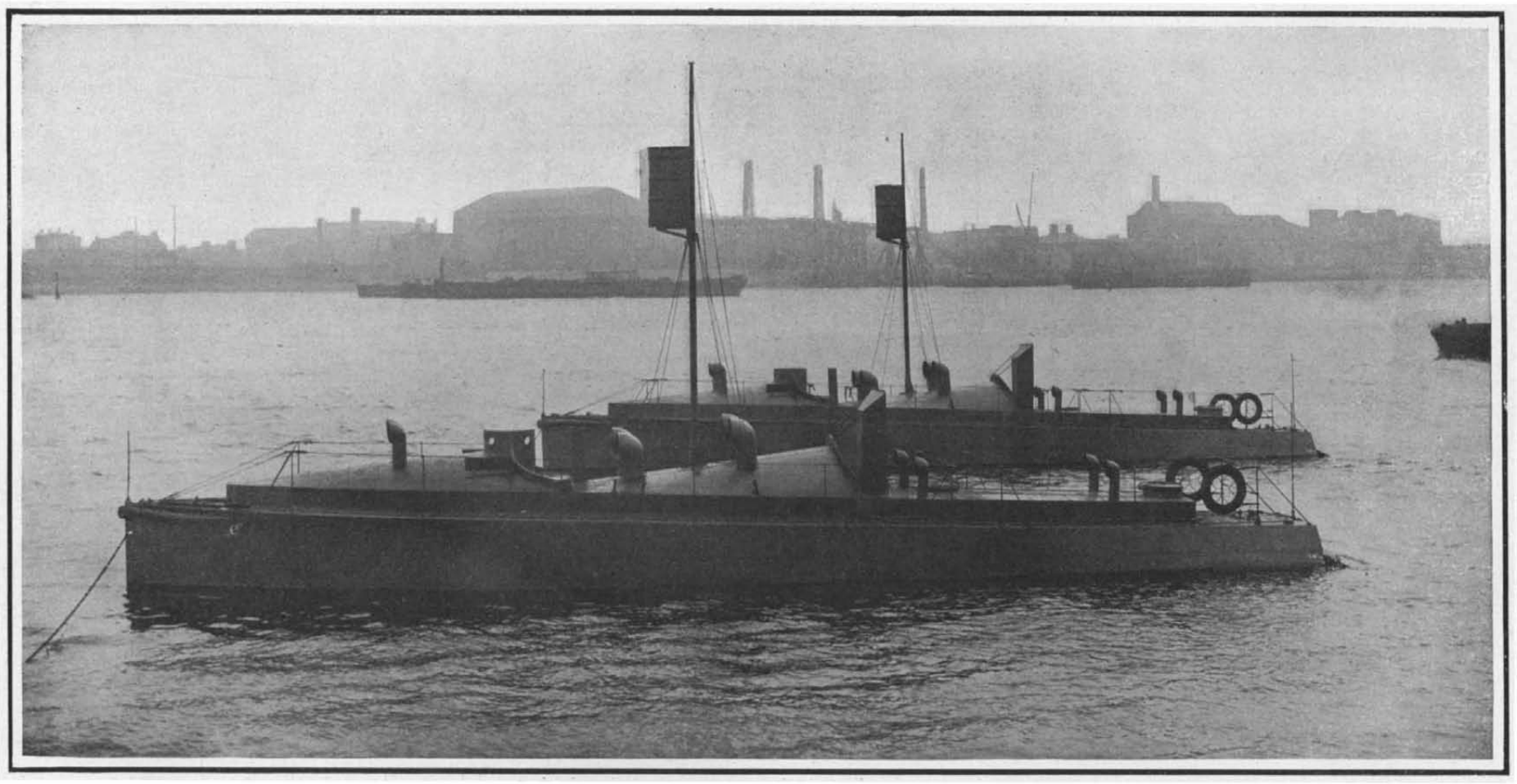
BY THE ENGLISH CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

The possibilities of applying the small explosion motor to certain light craft for naval duties, such as river patrol work, have been recently advanced by the construction of two gasoline-propelled shallow-draft gunboats for service on the river Danube. These craft were built by the British naval shipbuilding firm of Yarrow & Co. for the Austro-Hungarian government. Each vessel has a length of 60 feet with a beam of 9 feet and a draft of 32 inches. They are built on the Yarrow shallow-draft system, having three screws revolving in tunnels and fitted with twin rudders. The hulls are built of galvanized steel.

The propelling machinery aggregates 350 horse-power distributed in five sets. Each wing screw has two sets of four-cylinder vertical Yarrow-Napier motors having a bore of 6½ inches by a 6-inch stroke, mounted in tandem and each developing 70-brake-horse-power. Thus each wing has eight cylinders representing 140 horse-power. The central screw has only one four-cylinder set and the reversing gear is coupled only to this middle set.

A small conning tower is fitted forward, while right aft is a revolving gun platform. A light gun will be mounted on the platform in Austria. The machinery space as well as fuel reservoirs, conning tower, and gun mounting are protected by 3/16-inch chrome steel armor plates affording complete protection to point-blank rifle fire at short range. Amidships is a short detachable mast fitted with a crow's nest for look-out purposes and to provide an elevated rifle firing position. Special attention has been devoted to the ventilation of the machinery space so as to avoid the accumulation of any noxious gases.

In the official speed trials carried out on the Thames measured mile by the Hungarian naval officers the vessels attained a mean speed of 22.25 knots with a load of three tons during a run of one hour's duration. A consumption trial was then carried out to ascertain the radius of action at an average speed of about 11 knots per hour and it was found that the vessels carried sufficient fuel for a continuous run of some 500 nautical miles. This represented a radius of action three times in excess of what would be possible with craft of the same size propelled by steam. A distinguishing feature during the high-speed trials was the absence of any vibration. Accommodation is provided for a crew of six men, the sleeping appointments for which are placed fore and aft respectively.



TWO 350-HORSE-POWER GASOLINE-PROPELLED GUNBOATS FOR PATROL DUTY ON THE DANUBE.

Note the conning tower, the crow's nest, and the revolving gun platform aft.

The evil repute of the bedbug has acquired fresh justification. It is well known that most contagious diseases are disseminated by blood-sucking insects—malaria and yellow fever by mosquitoes, plague by fleas, the African sleeping sickness by *Glossina palpalis* (a near relative of the tsetse fly), anthrax, tuberculosis, smallpox, scarlet fever, typhoid fever, etc., by the common house fly. Now Jordansky and Klodentzky have proved by very delicate experiments, that bedbugs are the worst of all, at least in the dissemination of plague. Not only do they draw contagion from the bodies of men and animals stricken with plague but the germs live and multiply within the bodies of the insects, retaining their full virulence for many days. The bedbugs do not appear to suffer any inconvenience, for they live and remain active for months after they have absorbed the germs. Hence a few bedbugs might easily infect a regiment with plague and it is to be feared that they possess equal power to spread other diseases.

THE WRIGHT BROTHERS' AEROPLANE IN FRANCE AND THE UNITED STATES.

In view of the fine performances of Wilbur Wright with his aeroplane in France, and also of the flights about to be made by Orville Wright near Washington, at Fort Meyer, we are glad to be able to present to our readers, in this issue, the first actual detail photographs of this world-renowned aeroplane which the Wright brothers have heretofore kept closely veiled from public view. These photographs show that, as had been supposed from the descriptions of eye witnesses and also from the minute photographs taken at long range of the machine in flight at Kitty Hawk, their motor-driven aeroplane is of the greatest simplicity and is, in fact, merely their gliding machine with a motor and propellers added. In the photographs which we reproduce the reader can see that the machine is fitted with a double-surface horizontal rudder mounted in front and having a small vertical rudder at its center point, while twin vertical rudders are used at the rear for side steering. The two propellers are located at the rear of the main planes, and are driven in opposite directions by chains from the motor located on the lower plane a short distance to one side of the center line of the machine. A vertical surface seen at the front end of the motor is the radiator, which consists of a number of small tubes closely assembled. The machine is carried on wood skids placed a short distance below the lower plane and which project forward and upward to form a support for the front horizontal rudder. Suitable stays extend downward from the front edge of the upper plane to these skids and also upward from the front edge of the lower plane to their vertical uprights. Practically all of these features could be made out in the small photographs taken at Kitty Hawk and published and described by us several months ago.

The main planes are 40 feet long by 6½ feet wide, and spaced 6 feet apart. Their supporting surface is 500 square feet. The horizontal rudder planes are 16 feet long by about 2½ feet wide, their total surface being 75 square feet. The weight of the aeroplane without operator or supplies is about 800 pounds. With two men and a supply of fuel and water, it weighs about 1,150 pounds, which, if the area of the horizontal rudder is added to that of the main planes, gives a loading of the surfaces of but 2 pounds per square foot. As some of the recent French monoplanes carry from 3 to 3½ pounds per square foot of supporting surface, it can be seen that the Wright machine is not heavily loaded, the consequence being that it can rise in the air and fly at a speed of 26 miles an hour, although it is capable of traveling at the rate of 40. The machine in use in France has but two control levers, while the new one to be flown here has three. Two of these, which control the warping of the planes and the vertical rudders, can be worked in unison, while the third operates the horizontal rudder. The 4-cylinder, vertical, water-cooled gasoline motor (which is the Wright brothers' own design) is run at a constant speed of about 1,400 R. P. M. It drives the propellers in opposite directions at about 500 R. P. M. No carbureter is used, the gasoline being pumped into the cylinders above the inlet valves. According to Mr. Orville Wright, the speed of the aeroplane is varied by manipulating the surfaces and not by varying the speed of the motor. The method of operating the motor without a carbureter by feeding gasoline direct to the cylinders is that used by Farman with his 8-cylinder engine, and it is claimed that this method, although not economical of fuel, produces the best results when a motor is run at constant speed. The motor of the Wright aeroplane is placed in a fore-and-aft direction across the lower plane a short distance to one side of the center line, while the aviator and passenger sit beside the motor on the other side of this line and with their feet upon a cross brace below and in front of the plane. The frame and braces of the aeroplane are constructed of wood (spruce, ash, and pine), while unbleached muslin is used for the surfaces. No special pains have been taken to reduce the resistance of the various braces, with the exception of the uprights connecting the main planes, which are oval. The planes are braced in all directions with piano wire. They are flexibly connected so that they can be warped slightly by cords passing through pulleys and connected to the levers.

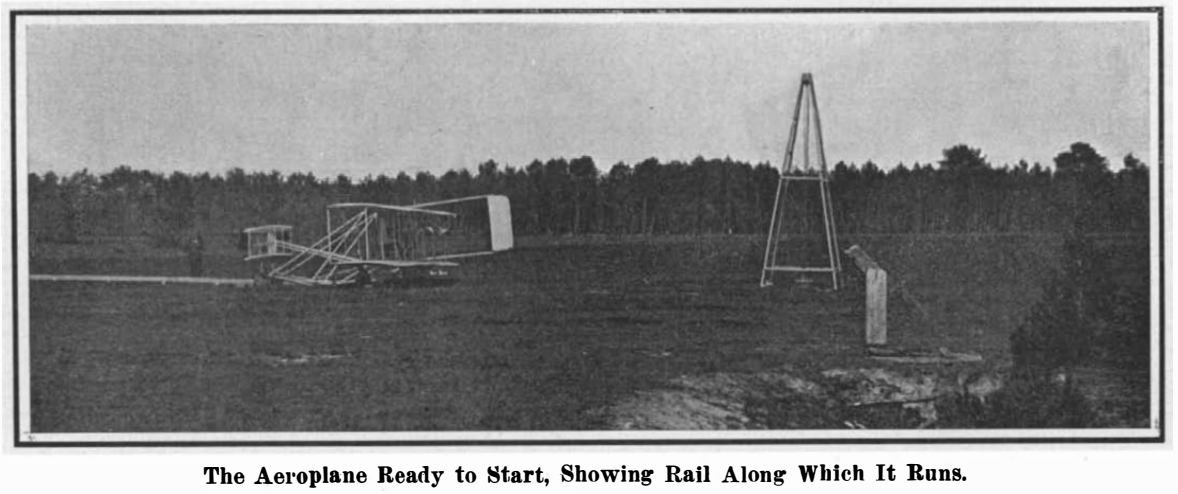
The main points about the Wright machine are its simplicity and efficiency. The former is apparent by a glance at the photographs, which also show some reasons for the latter, such as the lack of a tail and the almost flat surfaces set at a very slight angle of incidence. While there are apparently a good many braces to make head resistance, nevertheless these are chiefly concentrated at one point in the center part of the machine where the resistance of the motor, radiator and men are met with anyway. Besides the ease with which the machine glides through the air for the reasons above mentioned, the Messrs. Wright claim that their screw propellers (which are of wood and about 6 feet in diameter), give very great efficiency. This is another of the chief reasons why they can propel their machine at such high speeds with so little horse-power. The chain drive from the motor to the propeller shaft is also a fairly efficient form of power transmission. As a result of these various causes, they have succeeded in attaining a speed of 44 miles an hour with about 25 horse-power, which shows that their machine is practically 100 per cent more efficient than the best of those made abroad. When the question of stability and safety is considered, however, this machine does not appear to so great an advantage. It is true that the transverse and longitudinal stability can be maintained with great ease by the

warping of the ends of the surfaces and the use of the horizontal rudder, but there is nothing in the least automatic in the way this is done, the aviator being depended upon entirely to control the equilibrium of the machine by moving levers. If anything happened to the man directing the machine, or should he make a false movement of a lever, the aeroplane would either plunge suddenly to the ground, or turn a backward somersault. Should anything happen to the horizontal rudder (as has been known to do with other aeroplanes), the machine would be completely out of control of the aviator and it would probably be dashed to the ground; whereas with the Farman type of machine, which employs a steadying tail, an accident happening to the rudder might be counteracted by the tail, or *vice versa*. Thus, for the sake of simplicity and efficiency, the element of safety has been sacrificed to a considerable extent. In a machine for war purposes, however, speed and efficiency are most desirable and the aviator is willing to sacrifice a large factor of safety in order to be able to fly at high speed.

One of the photographs which we reproduce shows the aeroplane at the beginning of the track along which it runs in making its start. It is mounted on a small two-wheeled carriage, which is jerked forward by a falling weight arranged in the tower at the rear of the machine. This accelerates the speed of the aeroplane more rapidly than the propellers alone can do, and causes it to rise in the air after traveling a distance of barely 100 feet. The carriage is left behind, and the aeroplane, when alighting, lands on its skids. How it seems to start off and make a flight in this machine can best be told by the Wright brothers themselves, from whose article in the current Century Magazine we quote the following:

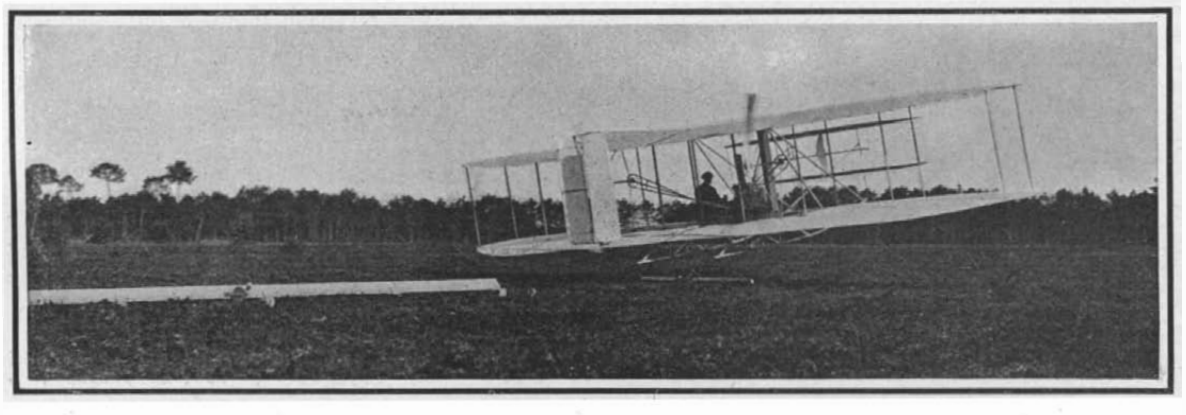
"In order to show the general reader the way in which the machine operates, let us fancy ourselves ready for the start. The machine is placed upon a single rail track facing the wind, and is securely fastened with a cable. The engine is put in motion, and the propellers in the rear whirr. You take your seat at the center of the machine beside the operator. He slips the cable, and you shoot forward. An assistant who has been holding the machine in balance on the rail, starts forward with you, but before you have gone fifty feet the speed is too great for him, and he lets go. Before reaching the end of the track the operator moves the front rudder, and the machine lifts from the rail like a kite supported by the pressure of the air underneath it. The ground under you is at first a perfect blur, but as you rise the objects become clearer. At a height of one hundred feet you feel hardly any motion at all, except for the wind which strikes your face. If you did not take the precaution to fasten your hat before starting, you have probably lost it by this time. The operator moves a lever; the right wing rises, and the machine swings about to the left. You make a very short turn, yet you do not feel the sensation of being thrown from your seat, so often experienced in automobile and railway travel. You find yourself facing toward the point from which you started.

The objects on the ground now seem to be moving at much higher speed, though you perceive no change in the pressure of the wind on your face. You know then that you are traveling with the wind. When you near the starting point, the operator stops the motor while still high in the air. The machine coasts down at an oblique angle to the ground, and after sliding fifty or a hundred feet comes to rest. Although the machine often lands when traveling at a speed of a mile a minute, you feel no shock whatever, and cannot, in fact, tell the exact moment at which it first touched the ground. The motor close beside you kept up an almost deafening roar during the whole flight, yet in your excitement you did not notice it till it stopped."



The Aeroplane Ready to Start, Showing Rail Along Which It Runs.

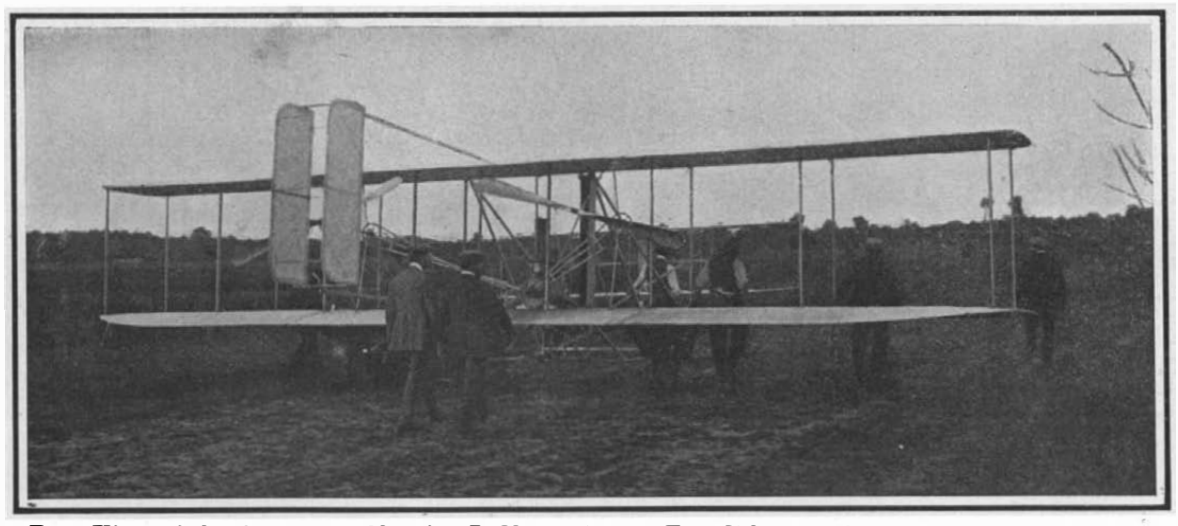
The tower at the right supports a heavy weight which is connected to the small car that carries the aeroplane. At the moment of starting, the weight drops and jerks the machine suddenly forward, thus accelerating quicker than is possible with the propellers alone.



The Aeroplane Leaving the Rail, Showing the Angle of Ascent Produced by the Horizontal Rudder.

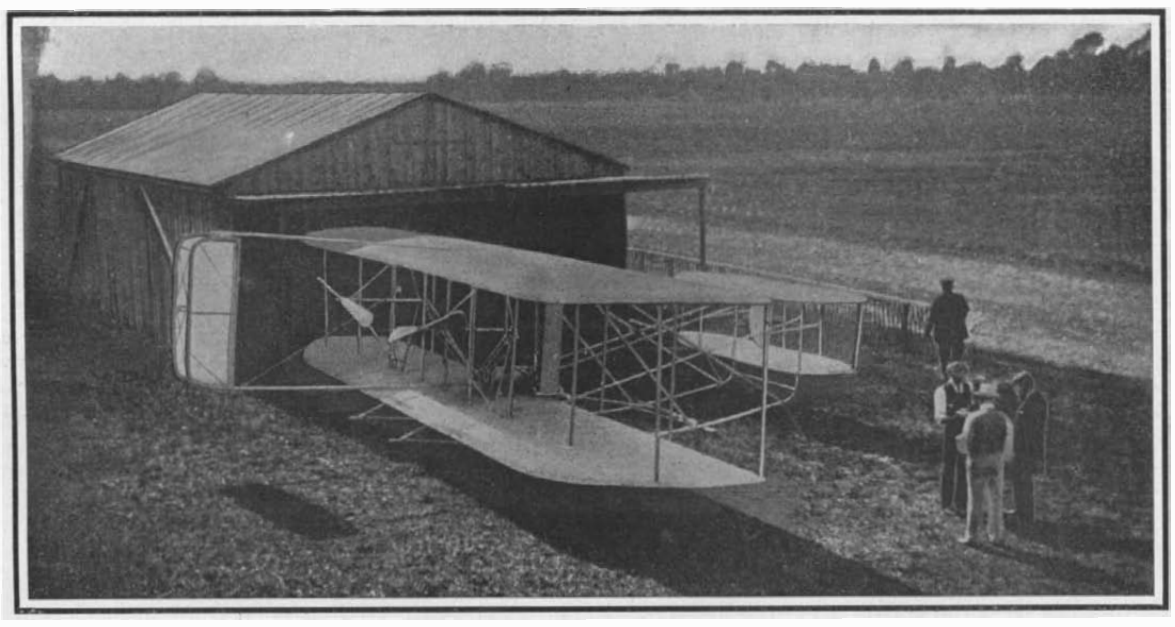
Some of the difficulties met with by experimenters in constructing a machine which will have good stability are also described in the same article:

"The balancing of a flyer may seem, at first thought, to be a very simple matter, yet almost every experimenter had found in this the one point which he could not satisfactorily master. Many different methods were tried. Some experimenters placed the center of gravity far below the wings, in the belief that the weight would naturally seek to remain at the lowest point. It was true, that, like the pendulum, it tended to seek the lowest point; but also, like the pendulum, it tended to oscillate in a manner destructive of all stability. A more satisfactory system, especially for lateral balance, was that of arranging the wings in the shape of a broad V, to form a dihedral angle, with the center low and the wing-tips elevated. In theory this was an automatic system, but in practice it had two serious defects: first, it tended to keep the machine oscillating; and, second, its usefulness was restricted to calm air."



Rear View of the Aeroplane, Showing It Mounted upon Two Wheels and Being Pushed Back to Its Starting Rail.

The 25-30-horse-power, 4-cylinder motor and its twin radiators are distinctly visible, as are also the inclosed chains which drive the propellers in opposite directions.



Three-Quarter Rear View of the Wright Aeroplane.

The aeroplane rests on skids which extend forward and support the horizontal rudder. Note the curved vertical rudder in the center of this, the vertical radiating tubes at front edge of main planes, the motor extending back from them, and the twin propellers and rudders at the rear.

SOME DETAILS OF THE WRIGHT BROTHERS' AEROPLANE.

From the above it will be seen that an aeroplane is largely a matter of compromise and that its form and surface must be determined from the uses to which it is to be put, and from whether it is to fly in winds or in calm air alone. The Wright machine has demonstrated that it can fly in a wind as great as 20 miles an hour, while none of the other aeroplanes have ever flown in a wind of half this velocity. In this one point alone it is far superior to all other aeroplanes; and doubtless, in time, the brothers will perfect it so that it will have automatic equilibrium and thus be capable of use by almost any individual. There are great possibilities, too, in the way of reducing the supporting surfaces and all parts of the machine to their minimum size and weight; for one leading experimenter in this line asserts that a two-man motor-driven aeroplane can be built which, complete, will weigh only about 150 pounds. Such a machine could be readily carried to a suitable starting place by the two men using it, and as a means of transport in inaccessible country it would be unsurpassed.

THE PROPAGATING INFLUENCE OF HIGH-TENSION ELECTRIC CURRENTS UPON PLANTS.

From time to time interesting experiments have been made to determine the influence of electric currents upon the growth of plants. The majority of such investigations, however, have been carried out only upon a limited scale, but the fact has been accepted that the artificial supply of electricity does increase the rapidity and assist the amount of growth. In order to test this theory upon an extensive practical scale, Mr. J. E. Newman of Gloucester, a well-known British agriculturist, completed arrangements for such an experiment, and approached Sir Oliver Lodge, F.R.S., to assist him in completing the electrical details of the project and to secure the maintenance of the requisite continuous high-tension discharge for hours together every day over a large area. The proposal was accepted by Sir Oliver Lodge, who in conjunction with his son, Mr. Lionel Lodge, carried out the electrical part of the scheme. The experiments were commenced in 1906 and have been continued ever since. Through the courtesy of the investigators we have been enabled to secure details concerning the equipment and the results that have been achieved.

The field selected for the operations was 11 acres in extent. It was sown with English and Canadian red fife wheat respectively. The overhead system of wires covered about 19.5 acres. The poles, for which larch was selected, were about 15 feet in height, so that the wires offered no interruption to loaded wagons and other agricultural implements passing beneath. The poles were disposed in parallel rows about 102 yards apart, the span between each post in each line being about 71 yards. By this arrangement about 22 poles were sufficient for the whole acreage representing approximately one pole per acre. The current was carried down each row by means of stout telegraph wire carried on elaborate high-tension insulators of special design, while thin galvanized-iron wires placed some 36 feet apart were stretched between the rows to act as the discharge wires over the crops beneath. For the purpose of securing comparative data concerning the influence of electricity upon the crops a small section was left without wires to serve as a control.

Owing to the flexible suspension the risk from breakage has been found to be very slight. During the two years the wires have been up, apart from a few breakages owing to extra high wagons with their harvest load coming into contact with the network and causing a few breakages, only one wire has fallen, so that the maintenance charges and repairs of the wires have been insignificant.

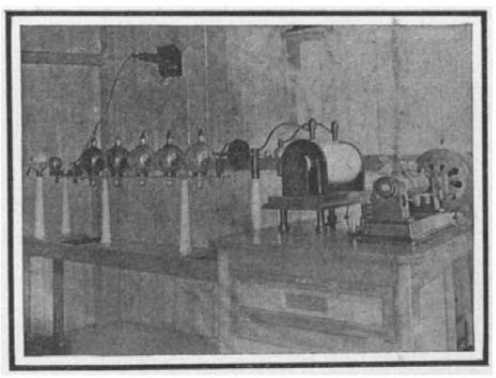
The electric current for such a purpose, as Sir Oliver Lodge points out, can be generated in several ways. It can be generated by the revolving glass plates of the Wimshurst machine, or by transforming up to high tension and rectifying to one direction the current of the dynamo. In this particular experiment both systems have been used but the former while in many respects the simplest, is not adapted to continuous or rough use, such as it is subjected to upon a large sized farm.

The experiments were commenced in 1906, but owing to delay in delivering some portions of the electrical equipment work had to be carried on with a somewhat improvised generating station. When, however, the electrical apparatus was received and the installation completed work was carried out upon the originally projected lines. The power is furnished by a 2-horse-power oil engine driving a dynamo placed in one of the out-buildings of the farm. The current so generated is transmitted by the usual overhead system to a corner of the field where in a weather-proof hut the transforming and rectifying apparatus is erected. The dynamo furnishes direct current of about 3 amperes at 220 volts. Upon reaching the transforming and rectifying station it passes through the primary of a large induction coil with a make-and-break contact interposed in the circuit. From the secondary of the coil the high-tension current passes through the rectifiers which comprise vacuum valves in accordance with the patented device evolved by Sir Oliver Lodge. From the rectifiers the current, now raised to a potential of about 100,000 volts, is conducted to one pole, by which it is distributed over the whole system of overhead wires. The negative electricity is conveyed direct to earth except when retardation is desired or during drought. By this arrangement the overhead insulated wires are maintained at continuous high positive potential.

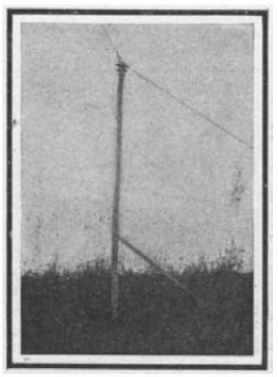
When the current is switched on leakage immediately begins from the overhead wires. At times the action is plainly audible, while at night it can be seen, a slight glow just being visible in the darkness. Evidence of the discharge can be experienced by anyone walking beneath the wires, the hair of the head being slightly stimulated owing to electrification.

The current is maintained for some hours each day but is shut off at night. Sir Oliver Lodge considers that it is probably only necessary to supply current during the early hours in summer time, and for the whole day in spring and in cloudy weather. In bright sunshine he considers it unnecessary, if not harmful.

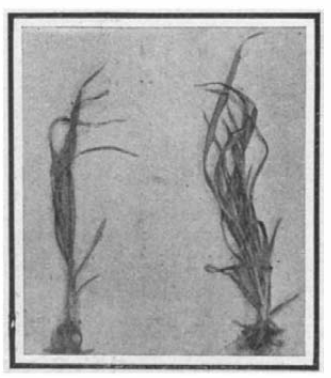
At what stages of the growth the electrification exercises the most stimulating effect has not been ascertained, this phenomenon affording an especial field for investigation. He considers that the greatest benefits are secured during the early stages of the plant's growth, and since in the case of wheat both the ear and straw are valuable, electrification should be applied for a time each day during the whole period of growth until stooling begins.



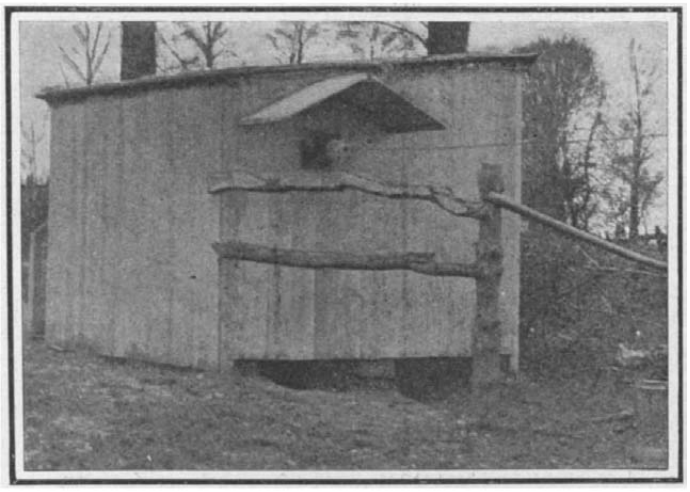
Generating and Transforming Apparatus. Note Mercury Converters Changing Alternating to Direct Current.



A Post Supporting the Discharging Wire.



Electrified vs. Wheat Grown Under Ordinary Conditions.



Transformer Shed and the Wire Which Carries 100,000 Volts, Direct Current, to the Field and Stimulates Plant Growth.

Insulator for Supporting Discharging Wire Compared with the Ordinary Telegraph Insulator.

THE PROPAGATING INFLUENCE OF HIGH-TENSION ELECTRIC CURRENTS UPON PLANTS.

In the wheat field the effects of electrification were observable at an early date. In the opinion of expert observers the young blades of the cereal in the treated area were of a darker green color, while the crop was judged as considerably heavier, the straw being on an average from 4 to 8 inches higher. Both the electrified and control area came into ear about the same time, but the Canadian wheat in the former section was ready for cutting some three or four days before that in the control area. During the 1906 season current was supplied for an aggregate of 621.75 hours, spread over 90 days. The average electrical pressure corresponded to a 0.75-inch spark, the current being shut off after the ears were in bloom. The results from the electrified and control acreage in 1906 in bushels per acre were as follows:

	Electrified plot.	Control plot.	Increase.
Canadian	35.5	25.5	39.2 p.c.
English	40	31	29 p.c.

This shows a heavy increase in the yield attributable to electrification, since the control was grown under precisely similar conditions. Moreover, the electrified wheat realized higher prices by some 7.5 per cent, several millers in baking tests finding that it produced a better baking flour. The increase, in the opinion of those concerned, appears to be mainly due to better stooling; no marked difference being observable so far as the development of the ears was concerned.

In 1907 wheat was grown in the same field, while 2.75 acres of an adjacent strawberry field were similarly provided with a wire network, with magnolias planted between the strawberry rows for the purpose of ascertaining the effect of such electrical stimulation upon fruit and root vegetables. In each instance a small control section was retained under precisely similar conditions for affording comparative data.

During the 1907 season the current was maintained for 1,014 hours, spread over 115 days, the average pressure corresponding to a half-inch spark, the current being kept on until harvest time. The effect of electrification was the production of 41.4 bushels per acre of Canadian red fife wheat from the electrified area as compared with 32 bushels per acre from the control section, showing an increased yield of 29 per cent attributable to electrification. In regard to the strawberry field this was not carried out under the most advantageous conditions, inasmuch as it was the first year of the planting, but the experiment was made to determine whether any increase could be secured by electrification. The results proved highly satisfactory, an increase in yield of 35 per cent being attained, while the fruit was observed to ripen more quickly under the action of the current. In regard to the mangolds, it being impossible to weigh the product, a rough estimate only was made, but this pointed to an augmentation of 25 per cent. Analysis showed an increase in the sugar percentage, but these results varied. In experiments with raspberries a marked improvement in growth was shown while small crops of tomatoes similarly treated showed a large increase in the crop. In regard to the raspberry canes a curious point was observed. The foliage and fruit on the old canes showed no difference, but the new growth particularly after pruning showed an enormous difference in favor of electrification, manurial treatment being the same in each case.

Baking tests with the wheat grown upon the electrified and unelectrified areas showed that the average of dry glutens in the two classes was respectively 11.5 and 10.35 per cent. Sir Oliver Lodge points out that although no theoretical conclusions can be drawn from the fact that the electrified wheat produces a superior baking flour owing to the uncertainty existing as to what factors determine the strength of wheat, it is interesting to note that greater strength is usually accompanied by increase in percentage of total nitrogen.

The power required to generate the electricity is very small, for although the potential is high the quantity is insignificant and the energy is comparatively trivial. So far as the expense incurred in carrying out a practical installation of this character is concerned the initial outlay is the most important item, maintenance and operating charges being very small, and the beneficial effects produced both in the quality and quantity of the cereals and other agricultural produce should soon result in the preliminary expenditure being recouped.

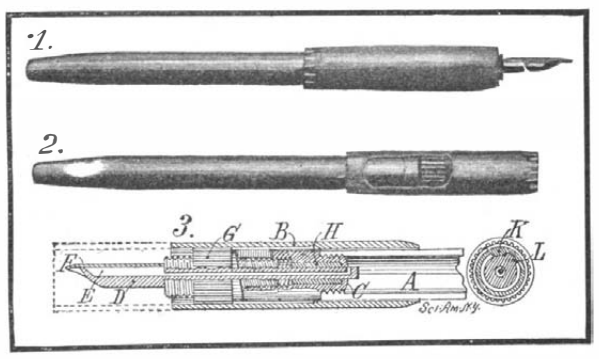
The experiments are being repeated during the current year the results of which will no doubt be published in due course. The application is being extended to other produce while some additional 20 acres of field have been equipped with the overhead wire network, the crops in which are being similarly treated this year.

France is to have two motor shows this year, one each for private and commercial vehicles; both will take place in the Grand Palais, and the annex across the Seine is to be abandoned. The show for pleasure cars will be open from the 28th November to the 13th December, and that for commercial motors from the 22d to the 29th December.

Patent Department

AN IMPROVED FOUNTAIN PEN.

The accompanying engraving illustrates a novel construction for fountain pens which is calculated to do away with the leaking of the pen when carried in the pocket and to provide means for regulating the flow of ink to the pen point. In our illustration the body of the pen is indicated at *A*. Mounted thereon is a sleeve *B* which serves as a cap to protect the point of



AN IMPROVED FOUNTAIN PEN.

the pen and also as means for regulating the valve which controls the flow of ink. Threaded into the body *A* is a thimble *C* into which, in turn, is threaded a feeder *D*. The latter is formed with a channel *E* which conducts the ink to the pen *F*. Secured on the feeder *D* is a sleeve *G* which is formed with a corrugated outer surface adapted to engage corrugations in the outer sleeve *B*. Owing to these intermeshing corrugations the sleeve *B* is prevented from turning relatively to the sleeve *G*, but may slide axially thereon. When the sleeve *B* is rotated it rotates the sleeve *G* and feeder *D* therewith, causing the latter to be screwed into or out of the thimble *C*. The feeder *D* is formed with an extension which passes through an opening in the thimble *C*. The channel *E* terminates in a transverse bore in the extension just referred to. When the feeder *D* is threaded inward the transverse bore is brought into communication with the ink reservoir in the body of the pen, permitting the ink to flow through the channel to the pen. On unscrewing the feeder *D* the extension is withdrawn and the bore therein is closed by the cork lining *H* of the thimble *C*. In this position no ink can flow out of the reservoir. The flow of ink through the pen is regulated by the extent to which the feeder is screwed in and this is determined by the relative position of a set of graduations on the sleeve *B* with respect to a fixed mark on the body *A*. When it is desired to lay the pen aside temporarily the sleeve *B* may be drawn forward to the dotted position without turning the feeder. When it is desired to carry the pen in the pocket the sleeve *B* is first turned to close the channel *E*, when the stops *K* and *L* will be brought into engagement, after which further turning will unscrew the thimble *C* from the body *A*. The device may be inverted and screwed point downward into the reservoir, as indicated in Fig. 2, a threaded shank being formed on the sleeve *G* to engage the threaded end of the reservoir *A*. A patent on this improved fountain pen has been secured by Mr. William A. Houston, of Tracy, Minn.

SOME NOVEL TYPES OF SHAVING BRUSHES.

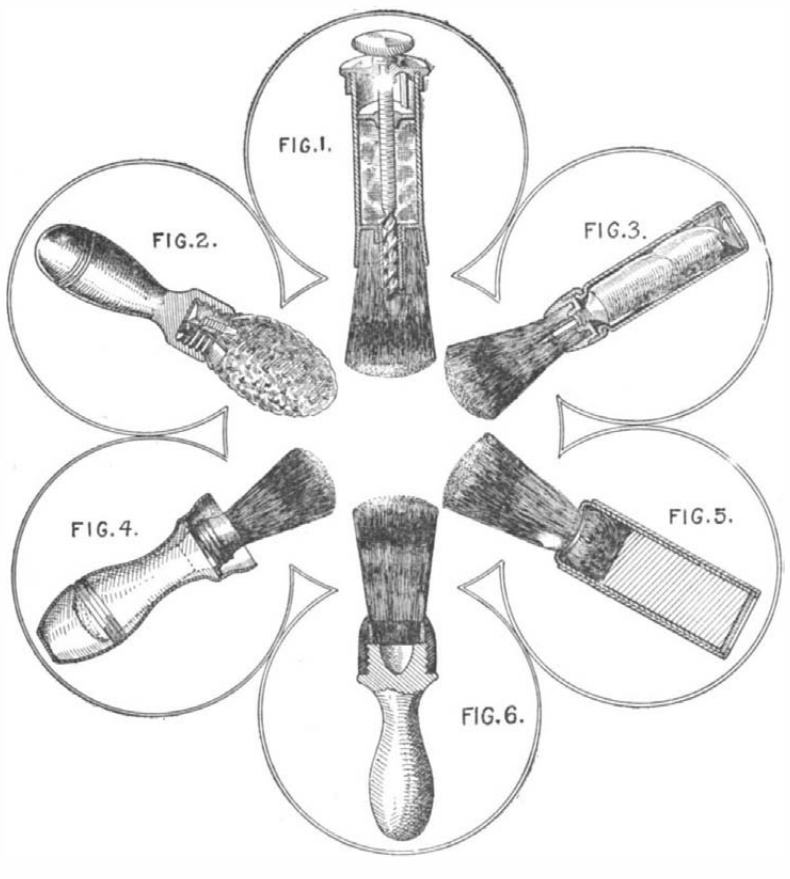
Shaving brushes acquire a good name mainly through the capacity of retaining the bristles in place, the means of withstanding antiseptic treatment and practical methods of casing the brush to protect it from dust, abrading, spacing, etc. These and other features make this familiar and useful implement something for inventors to conjure with. Several recent novel forms are shown in the accompanying illustrations. In Fig. 1 the shaving brush is of the fountain type. The handle forms a reservoir holding liquid soap. The knob is operated to turn a screw rod at the end of which is a spiral conveyer that carries the liquid into the bristles. The disk above the liquid acts as a follower to force the soap into the grooves of the spiral. The cap of the handle unscrews when it is desired to refill or clean the reservoir.

Fig. 2 shows a rather unique brush body of oval or egg shape made of rubber sponge. The inner end of the rubber is ingeniously formed for proper connection with the handle through the medium of a cup-like neck. The improvement is a characteristic departure from the use of bristles.

The third brush is of a type which leans to economy in the use of lathering material. The soap in liquid form is contained in a soft metal tube such as oil paints are kept in. The outer casing of the brush is made of pliable hard rubber or light spring metal. Pressure on this affects the inside tube so that the soap is forced out into the midst of the bristles. The orifice in the end of the handle is controlled by a valve and the displacement of the liquid from the tube to the bristles is thus pneumatically performed and in a manner similar to the operation of an oil can.

The next illustration pictures a device particularly adapted for the traveler, but should be found useful for others as well, because it will not drip and because the bristles can be incased to protect them from the dust. By unscrewing the handle cap the bristles part is removed and then screwed into the other end of the handle for use in lathering. The surplus water and lather drops through orifices at the base of the bristle-setting into the cup, leaving the outside of the holder perfectly dry. These drippings may serve for a finishing shave. When the user is through shaving the brush is snugly fitted into the casing as indicated by dotted lines and is thus folded into a small compass for packing.

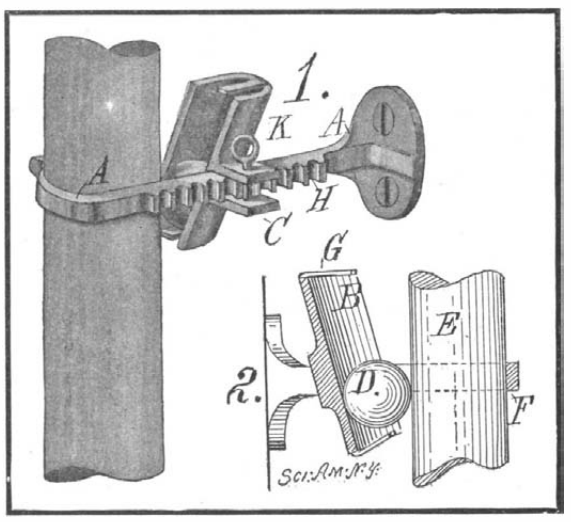
The fifth illustration shows an adaptation to sterilization. The bristles are carried by a sleeve consisting of two parts which surround the inner end of the tuft and clamp the same between them. This sleeve is held in clamped position by an outer casing. The tuft is released from the handle by pushing out the inner sleeve which when free from the outer holder or casing will fall open. The tuft may then be sterilized and replaced in the sleeve and holder. In the last figure a brush is represented whose improvement is in the setting. The bristles are solidly imbedded in soft rubber. A metal belt which is covered with a rubber ferrule binds the rubber mass. The whole is then placed in a die and vulcanized under heat and pressure. The vital point and one not secured in the ordinary processes is reached in this case through absolute resistance to various actions that tend to dissolve a setting of bristles.



SOME NOVEL TYPES OF SHAVING BRUSHES.

HOLDER FOR BROOMS AND SIMILAR ARTICLES.

A patent has recently been granted on a holder of ingenious form which should be useful in the kitchen or household, to hold brooms and similar articles. The holder is so arranged that the handle of the broom is gripped under action of its weight as it is inserted, and it is suspended in a substantially vertical position. The device may be adjusted to suit handles of different sizes, and its gripping action is proportional to the weight of the article. It comprises a bracket *A*, which is secured to the wall and a member *B* mounted thereon. The latter is formed with a recessed portion adapted to receive and retain a ball *D*, and with a pair of laterally projecting lugs *C* between which the arm of the bracket is engaged. The handle of the broom, or other article is gripped between the ball *D* and a finger *F* on the bracket *A*. The recessed member in which the ball *D* is contained is inclined at an angle with the vertical and the ball normally rests against a stop at the bottom of the recess. A similar stop *G* is placed at the upper end of the recess to prevent the ball from being accidentally disengaged from the member *B*. To adjust the holder for different sizes of handles the member *B* may be secured at any position along the projecting arm of the bracket *A* by means of a pin *K* which passes through the lugs *C* and engages any one of a series of vertical grooves *H*. It



HOLDER FOR BROOMS AND SIMILAR ARTICLES.

will be clear that on passing the handle of the broom up between the finger *F* and the ball *D* the latter will be raised but on releasing the broom the ball will be drawn down by the weight of the broom and will wedge the handle against the finger *F*, thus securely holding it in a substantially vertical position. The inventor of this improved holder is Mr. Elgin Morell, of 44-48 West 18th Street, New York, N. Y.

Shoe Varnish.

A waterproof shoe varnish resembling patent-leather in luster is compounded of shellac, one ounce; alcohol, three ounces; a pinch of lampblack to color. Owing to the unfavorable action of alcohol on leather, this shoe varnish is not to be recommended for brand-new shoes; but to rehabilitate old shoes to a pristine shine it is unsurpassed.

The tendency of shoes being cracked by it may very largely be averted by first treating the leather to several coats of fish oil or vaseline, well rubbed in, over which a very thin coat of paraffine is applied hot, and the excess immediately wiped off; the shoes should then be burnished with cotton flannel until the surface is smooth, and apparently dry and free from oil or paraffine. The shoe varnish is then thinly applied with a small sponge fastened to a wire. Several thin coats put on several hours apart may be necessary to get full luster. After that, usually one thin application is sufficient. Patent-leather paste polish, rubbed over it and burnished with flannel, softens the glitter, and leaves a very handsome bright surface. The chief other advantage to be derived from its use comes from its resistance to water. It is, therefore, invaluable when applied to preserve the good looks of the sides of the soles and heels of shoes to be worn in bad weather; and even to waterproof their bottoms.

A Simple and Effective Method of Christening Umbrellas.

Name plates on the handle seldom assist in the recovery of even borrowed, to say nothing of lost, umbrellas. But there is a way by which you may so mark your umbrellas that the finders and borrowers thereof will be reminded of your name and address every time they stealthily sally forth with your umbrella over their heads. Make a paste of cornstarch with water; brush over the inner surface of the umbrella where you wish to have your initials, or your name in full, either with or without your street address. When this paste is dry, paint your name on the cornstarch, using pure white lead. Let the paint dry thoroughly; rub a stiffish brush over the whitened surface until the cornstarch is removed.

You will thereupon find the white letters of your name standing forth immaculately against the black background of your umbrella cover. The cornstarch paste is applied to keep the oils of the paint from penetrating the umbrella cover, and showing on the outer side. As it is, no unsightly grease spots come through. Your name is fixed, and if painted near the tip, it will be unobtrusive to you, though a constant reminder to the borrower or finder.

RECENTLY PATENTED INVENTIONS.

Pertaining to Apparel.

NECKTIE ATTACHMENT.—W. A. BAUER, Philadelphia, Pa. The purpose of the invention is to provide an attachment to a four-in-hand or other tie, scarf, or necktie, and an accompanying device whereby to conveniently and expeditiously shift the tie when used in connection with a turn-down collar, to bring the knot at the proper position relatively to the front of the shirt.

Electrical Devices.

MACHINE FOR CASTING BATTERY-GRIDS.—J. A. SMITH, New York, N. Y. The metal being ready, it is poured into slots and apertures. It finds its way through the slots and passages crossing the same, thus forming a grid. The operator now depresses the most convenient treadle. The rods being thrust obliquely upward cause the lifting bars to raise all of the various movable matrix bars. This disengages the newly formed grid and raises it from the fixed matrix bars which engage it and to which it may have tendency to cling. His foot is now removed and thus allows the plate to be removed from the machine.

TROLLEY.—A. S. JANIN, New York, N. Y. One of the purposes of this invention is to provide a trolley of very simple, durable, and economic construction, wherein the frame is of such shape that in itself it acts as a guide for the wire to and from the contact roller, and as a fender for the gearing and joints of the frame.

Of General Interest.

PAPER AND LETTER HOLDER.—A. D. ALBRECHT, Greenville, Ill. The invention pertains to devices for holding newspapers, letters, and similar articles. The object is to produce a device which can be readily mounted upon a wall or post for the purpose stated. The body of the device is of a construction which adapts it for being formed of stamped sheet metal.

POCKET CHECK-BOOK.—F. C. RHODES, New York, N. Y. The invention refers to check books such as business men carry in their pockets for drawing checks against their bank deposits. The object of the improvement is to produce a check book having a construction which especially adapts it for carrying the balances forward as checks are made out and torn off.

FLUSH-VALVE.—J. W. KENNEDY, Missoula, Mont. The principal object of the invention is to provide a reservoir connected with the bowl of the water closet, valves admitting water from the inlet pipe to the reservoir and to the bowl, the water supply being shut off when the water in the bowl reaches a predetermined level. By the use of the invention it is impossible for the water to overflow the bowl.

URINARY APPARATUS.—D. GIROUARD, Leominster, Mass. The purpose of this invention is to provide novel details of construction for a urinary apparatus, which are simple, practical, and efficient in service, and adapt the devices for convenient and comfortable wear upon the person continuously, if necessary, ready for instant service as occasion requires.

REGULATED AUTOMATIC SWINGING CHECK-VALVE WITH OVERFLOW ATTACHMENT.—O. E. NOBLE, Hobart, Okla. The invention relates to a check valve to be placed somewhere near the foot of an elevated tank or similar reservoir that is not high enough to afford sufficient pressure in case of an extended fire, when it is desired to put direct pressure from the fire pump, and also to prevent the elevated tank or similar reservoir from overflowing.

STORAGE-CABINET.—U. W. MASHTAB, New York, N. Y. The object of this inventor is to provide a cabinet which is supplied with ventilating means for keeping the air pure and free from the gases which are formed as cigars ferment. A further object is to provide a device having perforated walls spaced from the sides of the casing, and ventilating openings, this construction facilitating the circulation of the moistened air.

PUMPLESS STEAM-SPRAYER.—C. D. SAXTON, Boise, Idaho. The objects of the invention are to apply the solution (which is applied to trees and other vegetation for the killing of different kinds of infection) from a tank under steam pressure in a cold or hot state, to prevent the condensing of the steam in the tank when a cold solution is used, to fill the tank when empty by suction caused by the condensation of the steam therein and to provide for the thorough mixing of the solution while in the tank, as well as the heating thereof.

DESK.—H. M. LEESE, Washington, D. C. In operation the slide rods are normally pressed upward by their springs to unlocked position, and will immediately unlock the drawers when the cover is even slightly opened, such movement moving the bolts away from the upper ends of the rods so the latter may rise under the influence of their springs. To unlock the drawers without raising the cover, the key may be inserted in its proper lock and turned to retract one of the bolts named, in which event corresponding drawers will be unlocked without requiring the cover to be lifted.

Hardware.

TOOL.—H. E. PASTORIUS, Colorado Springs, Col. In this patent the invention is an improvement in tools of the character which are foldable within a handle when not in use, and its object is to provide a tool of this nature which will retain its rigidity with the handle when in operative position after hard and constant usage.

SAFETY-RAZOR.—J. H. FLAGG, New York, N. Y. In this construction all of the parts save the blade are attached together so that there is no liability of any becoming lost. The edge of the blade which is not being used is concealed and protected, so that it cannot contact with any object to injure the latter or dull the former. The guard is adjusted in a simple manner, and is itself provided with a cup, preferably integral therewith, to receive the latter from the blade.

Heating and Lighting.

STEAM-GENERATING APPARATUS. — J. ATWOOD and G. ESCHER, Washington, D. C. The invention is an improvement in steam heating apparatus, and particularly in the means for generating the steam. The boiler is provided in sections with hot air flues receiving the heat directly from the burners and extending up through water legs, and thence laterally through tubes connecting the sections, and circulating within the sections, and thence passing out between the same. It is especially designed for use with gas and for suspending from the ceiling of a room, the apparatus being comparatively small.

GAS-GENERATOR.—W. THOMAS, Vancouver, British Columbia, Canada. This apparatus generates producer gas, water-gas, or carbureted water-gas, as may be required. It is adapted to work under suction or pressure, and for utilizing various forms of gas-producing fuel, such as low grade coal, coke, tar, oil, peat, saw-dust or refuse-wood, garbage, and other organic substances.

MANUFACTURE OF FUEL BRIQUETS.—D. BENNETT, Battle Creek, Mich. The intention in this case is to provide improvements in the manufacture of briquets from peat and other similar materials, whereby the resinous and like substances contained in the material is distributed uniformly throughout the material, to insure the formation of a briquet capable of burning uniformly and of utilizing the units of heat to the fullest advantage.

HEATING APPARATUS.—T. J. PORTER, Sacramento, Cal. The purpose of the inventor is to provide a practical heating apparatus, which affords convenient economical means for simultaneously heating a number of hard bowlders, or cobbles which is the preferred rock material, a sufficient degree for their subsequent disintegration by application of water; and finally crushing in a suitable machine.

CIRCULATORY SYSTEM FOR FURNACES. B. L. WORTHEN, Tucson, Ariz. Ter. More especially the invention relates to furnaces of the various types used for metallurgical processes, such as reduction of ores. The more particular object is to utilize the waste heat of the water contained within the water jacket so as to improve the general efficiency of the furnace, and also prevent the otherwise objectionable effects of the heat.

HEAT-REGULATOR.—G. L. HOPPING, Long-beach, Cal. The invention relates to linotype and other machines requiring an even temperature of molten metal, air, or other fluid. The object is to provide a regulator, simple and durable in construction, sensitive in operation, and arranged to control the flow of gas to the burners, irrespective of the gas pressure.

FURNACE-ROOF.—F. MILLIKEN, New York, N. Y. The invention is an improved roof, more especially designed for open hearth steel frames, and having for an object primarily to provide for the expansion and contraction of the roof in both a longitudinal and transverse direction. The roof will operate to deflect the heat to the bath of the furnace and have a natural tendency to remain tight at the joints, and prevent escape of heat.

Machines and Mechanical Devices.

BOX-LOOM.—B. FUHRER, Scranton, Pa. The object of the invention is to provide a loom in which the picker mechanism receives an auxiliary shifting motion besides the regular picking motion, so as to cause the picker to push the shuttle back into proper position in the shuttle box, in case such shuttle has passed onward beyond the box and rendered the subsequent raising and lowering of the box difficult and dangerous to the mechanism of the loom.

WIRE-FENCE STRETCHER.—W. HOPPER, Jefferson, Iowa. The invention refers to certain improvements in devices for stretching wire fences while the wire is being secured to the fence post, and more particularly to that type of stretcher in which a clamping mechanism is employed in connection with clamping means, whereby the latter is prevented from becoming disengaged during the stretching action.

SEPARATOR.—F. PARDEE, Hazleton, Pa. The machine separates substances differing in specific gravity or frictional resistance, wherein the utilization of frictional resistance is employed in connection with gravity, particularly in the separation of coal from slate. One purpose of the invention is to provide a separator so that different kinds of substances submitted to its action will be automatically divided or assorted.

FIRING MECHANISM FOR GUNS.—J. R. BLOCKER, Austin, Tex. The invention relates to fire arms and especially to double-barrel shotguns, the more particular object being to employ a single trigger and parts associated therewith, so arranged that the operator may have complete control over the order in which the barrels are successively discharged and in which any predetermined order may be changed at will without the necessity for opening or "breaking" the gun.

WEIGHING-SCALE.—J. H. MCLEOD, La Salle, and A. MCLEOD, Peru, Ill. The scale is automatic in its action and intended for the weighing of grain, coffee, cement, and other materials, and is of the type in which a hopper is provided with a partition forming the hopper into compartments, each of which has a swinging bottom; and approved mechanism is provided for opening and closing the swinging bottoms alternately. One compartment empties when a predetermined amount of material has been received by the adjacent compartment and is made ready for receiving the material.

Prime Movers and Their Accessories.

ROTARY ENGINE.—T. HOKANSON, Newark, N. J. This invention relates to certain improvements in rotary engines adapted to be operated by steam or any other motive fluid under pressure, and relates more particularly to improvements of that type having a piston carried by a rotary piston wheel and movable through an annular chamber normally subdivided by a sliding abutment.

Railways and Their Accessories.

CAR-FENDER.—J. P. WOODCOCK, New York, N.Y. A purpose in this case is to provide a very simple, durable, and economic form of fender capable of application to the truck of any car, which fender will be beneath the platform and will perfectly safeguard a person or object struck from contact with the wheels of the truck.

RAILROAD CROSS-TIE.—W. BOYER, Valentine, Neb. The improvement refers to cross ties for railroads formed of metal. When such ties are cast into form, it is difficult to render them solid throughout their bodies, and in consequence such ties are liable to break; furthermore, resilience, which is desirable in a metal tie, is very slight in such ties as are formed in one piece by casting or other analogous means.

CAR.—B. F. BRUMAGHIM, Mount Hope, W. Va. The dumping car has the bottom inclined in opposite directions from the center and doors are provided at the sides of the car for outlet of material. The doors are operated by a system of links and levers to which motion is given by means of wheeled brackets at the sides of the car near the top. The wheels of the brackets are adapted to travel on guide rails at the point where the load is to be dumped; the track rails at the point of dumping are depressed or the guide rails mentioned are raised for the automatic operation of the car doors.

Pertaining to Recreation.

AMUSEMENT DEVICE.—H. A. BRADWELL, New York, N. Y. One of the purposes here is to provide a device so constructed that a platform or table is caused to revolve within an inclosure having cushioned or buffer sections, and wherein receptacles for passengers have independent movement on said platform, the receptacles having cushioning sections adapted for engagement with each other and the rebounding sections of the inclosure.

DEVICE FOR HANDLING AMUSEMENT-CARS.—A. F. BIAVATI, Freeport, N. Y. The more particular purpose of this inventor is to provide means for readily handling the cars employed. The invention comprises apparatus for lifting a car from one level to another, so as to bring the support of the car into registry with a railroad truck, then tilting the supporting mechanism so as to cause the car to glide obliquely downward along the track.

ROWING APPLIANCE.—W. F. JAMES and W. T. DEACON, Velasco, Texas. This appliance is for use in row-boats, and is of the character which embodies oars each made in two sections pivoted together, and so supported that when the oars are pulled, the handles and blades thereof move in the same direction, whereby the operator faces the bow in propelling the boat and is thus enabled to observe the direction of travel.

Pertaining to Vehicles.

PNEUMATIC HUB.—J. DUCHAN, Elizabethport, N. J., and R. DUCHAN and J. DUCHAN, Vienna, Austria. The object of this invention is to provide a pneumatic hub which will be simply constructed with a view to enabling the pneumatic cushion to be readily removed or replaced when desired. The invention is expected to be especially useful in connection with automobiles and similar vehicles.

VEHICLE-WHEEL.—L. H. BARRY, Durango, Mexico. In this instance the invention refers to improvements in vehicle wheels of the class having metal spring tires, the object being to provide a wheel of this character that will be comparatively light, yet strong and serviceable, and that will meet all the requirements of a cushioned tire.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Notes and Queries.

HINTS TO CORRESPONDENTS.

Full hints to correspondents were printed at the head of this column in the issue of August 8th, or will be sent by mail on request.

(10833) T. W. A. asks: I have been making a dry battery which when it is just finished shows from 22 to 26 amperes, but after standing a while, say from 5 to 7 days, will only show 5 or 6 amperes. What is the cause of it, and how can I remedy it? The cell is of the ordinary size, 22 x 6 inches, made of a zinc can lined with paper soaked in a solution of water, sulphuric acid, and bichromate of potash, carbon in the center of can surrounded by a mixture of coke dust, bichromate of potash, sal-ammoniac, graphite, sulphuric acid, and water, all packed in tight and sealed at the top with tar. Would you kindly tell me how, if possible, it can be made so it will not lose its strength so soon? A. The cell you describe is not a dry cell at all. It polarizes and cannot be sealed up and left to itself. The bichromate of potash and the sulphuric acid should be left out, and the cell made to conform to the instructions for making dry cells. The sulphuric acid will act continuously on the zinc whether the cell is in use or not. A dry cell is one which may be left on open circuit without deterioration. Yours cannot be left in that way. We can furnish you full and accurate directions for making dry cells in the SCIENTIFIC AMERICAN SUPPLEMENT Nos. 1363 and 1387, price ten cents each.

(10834) P. C. T. says: What are the best thermo couples? What are the best for high temperature? What are the best for high temperature, not alloys? Will careful riveting answer? Of what metal should rivets be? Does amount of surface in contact at ends determine amount of current at any given temperature? Are thin strips as efficient as thick, or does thickness make any difference? Does amount of current depend on width for any temperature? Does a varying range of temperature produce a greater voltage or amperage, or both? Does current increase at a uniform rate with increasing range or difference of temperature? Is a limit reached before destruction? Can you give me some particulars in regard to sizes and references of temperature for producing a given current? The thermopile mentioned in connection with new gas lamp (issue May 30, 1908), it says copper, aluminium, and nickel are used. Does it mean copper with either? A. All the questions regarding the thermopile may perhaps be disposed of by the statement that there is no thermopile of a commercial character on the market. It may almost be said that the thermopile is simply a delicate heat-measuring instrument. A few years ago one was placed on the market for charging small storage batteries and such light work as running sewing machines, but the company making it soon went out of business. Thermo-electric batteries, adapted to certain operations in chemistry, made abroad, can be purchased. One of these, giving 4 volts with 66 elements, is quoted in a dealer's catalogue at $105. This would be a very expensive mode of getting an electric current. The largest voltage which we have noted is given by the alloy of copper 60 and nickel 40 parts, which is called constantin, and an alloy consisting of antimony 122 and zinc 65 parts, but this gives only a small voltage. It will withstand a high temperature, about 900 deg. Fahrenheit. The joints of thermocouples for high temperature must be riveted or welded. Any metal will answer for the rivet. The size of the bars acts to reduce resistance and thus increase amperes, but has no relation to the voltage. Mere difference of temperature does not increase the voltage necessarily. There is for every couple a temperature of inversion, at which the current begins to decrease, and when the hot junction is as much above the temperature of inversion as the cold one is below that temperature, the current becomes zero. If the hot junction is heated still higher, the current is reversed and flows in the opposite direction. As to the sizes to be employed in making a thermo-electric battery, rather small bars will of necessity be selected because of the large space which will be taken up by large bars. A quarter-inch bar would seem to be sufficient if you wish to experiment in this line. The principles of the subject may be found in the higher textbooks of physics, such as Carhart's, price $1.50, and Watson's, price $3.50. Only two metals are employed in one instrument.

(10835) S. K. H. asks: 1. What is the theory of the working of an electrolytic detector? A carbon needle detector? A. The electrolytic detector has its resistance increased by the passage of a current. A microscopic examination shows that metallic particles are detached from the positive electrode and deposited on the negative electrode, until a bridge is formed which reaches from one electrode to the other. An oscillating current disrupts this bridge and renders the electrolyte non-conducting. This is fully explained in Maver's "Wireless Telegraphy," price $2.00. 2. What is the output in volts and amperes, and frequency

from the alternating current side, in a Wonder Alternator? The direct current side is wound for 10 volts, 1½ amperes; both sides using the same winding. A. There is a drop of ten per cent. or more in a rotary converter. We have no figures for the special one about which you ask. You should refer the question to the makers of the machine. 3. State some good books on elementary chemistry and price of same. A. We recommend and can supply Smith's "Inorganic Chemistry," price $2.25, or Remsen's "College Chemistry," price $2.50. Both are authorities. 4. What is the address of Massachusetts Institute of Technology? A. The Massachusetts Institute of Technology is located in Boston, Mass.

(10836) R. R. B. writes: A friend claims that if a live fish is put into a vessel partially full of water and swims around without touching the bottom or sides, although not a drop of water is spilled, the fish and the receptacle and the water will weigh no more than merely the receptacle and water. He attempts to explain it by arguing that the fish is in equilibrium and is therefore not a dead weight; I consider that, as the specific gravity of the fish must necessarily equal that of the water to maintain the equilibrium, the downward force exerted on the water by the fish must equal that of an equal volume of water, which would of course increase the weight of the outfit. Which is correct? A. If a fish is put into a tub of water, it displaces water; if the fish is in equilibrium under the surface of the water, it is displacing its own weight of water, and the water in the tub is made deeper by the displacement due to the fish. It is just the same then as if the same weight of water were poured into the tub. If a fish be put into a tub the tub is made just as much heavier as if the same weight of water were poured into the tub. 2. I have heard that a buzzard, after flying up into the air, sometimes rests on his wings, and without moving them or any other part of his body, goes to sleep and does not change his position relative to the earth at all, neither approaching to nor receding from it. Is this so? A. We are not familiar with the actions of a turkey buzzard, but we can say that we do not believe that any bird can float in air without moving a wing, and neither rise nor sink in the air. It could if its weight were the same as that of the air it displaces; but all birds we know are heavier than air.

(10837) R. E. S. C. says: Will you kindly inform me the relative position of the magnetic north to the true north for this longitude, how many degrees apart they are and which is east or west of the other, and if the norths are represented by distinct symbols on the compass dial such as an *arrow* for magnetic north and N. for true north. A. The magnetic needle at your place points about 12 deg. to the west of true north, that is, the magnetic declination is 12 deg. west. Nearer than that we are not able to give it since your place is not given in the government tables which we have. Should you wish the exact figures you can doubtless obtain them by addressing the director of the United States Coast and Geodetic Survey, Washington, D. C., who has in charge this work, and whose force is making determinations in various parts of the country year by year. The words East and West in connection with magnetic declination tell on which side of the true north and south line the magnetic needle points. It is not desirable to indicate declination upon a compass dial, since the declination changes year by year. In the eastern part of the United States the declination is west and increasing each year. Nor does this change correspond to the longitude.

(10838) R. P. C. says: We have two car wheels cast on an axle and a straight level track. A third rail is placed between the two rails in an elevated position so it comes in contact with axle and parallel to the other rails. Will the axle travel the same distance on the third rail without slipping as the two wheels do on the track in the same number of revolutions? A. Anything rolling on a track moves along in one revolution a distance equal to its circumference. If your car wheels are 24 inches in diameter, the circumference will be a trifle more than 75 inches, and the wheels without slipping will move that distance in each revolution. If the axle is 4 inches in diameter it would roll a little more than 12½ inches in each revolution. It must keep up with its wheels and so must slip on the third rail the rest of the 75 inches every time the wheels revolve once.

(10839) W. H. R. says: In the course of an argument I stated the fact, or at least what I considered a fact, that waves have no power of force but are merely a motion which would not carry anything forward. Am I right in this assertion? A. Any wave which is a mere vertical motion of the water would have no mechanical value or power, but the waves as they beat against the shore have great force, which is sometimes utilized for doing work. The ocean waves which beat against a vessel often break strong iron rods and twist them into shapeless masses. It would be useless to deny force to such waves. There are few waves which are merely tossings of the water. The force of waves combing upon the shore is largely due to the momentum of the water as it rushes up a sloping shore. At the most, your statement is a half truth—true only for one form of wave.

NEW BOOKS, ETC.

BALDWIN ON HEATING. Sixteenth Edition, Revised and Enlarged. By William J. Baldwin. New York: John Wiley & Sons, 1908. 12mo.; pp. 404; 143 figures and 15 plates. Price, $2.50.

In 1879 the first edition of this work appeared. It could be called nothing more than a collection of suggestions or hints, as stated in the preface of the earlier editions. These earlier editions were the publisher's editions, being reprints with slight corrections, but without revision. So far as the work related to the principles of steam heating, where the water of condensation is returned by gravitation to the boiler, there could be little change in the book. To bring it down to modern practice in the use of steam by other methods, a general revision was necessary. Therefore, the whole former book is superseded by one whose data and practice harmonize. The author, therefore, endeavors to give some facts relating to the principles of modern steam fitting, which, since the writing of the first book, has risen to the dignity of a branch of engineering science that may be known as domestic engineering, and which includes substantially all that goes to make up the engineering plant of a modern city building, excepting electric light and elevator systems, which do not properly belong to the subject.

LIFE AND LETTERS OF HERBERT SPENCER. By David Duncan, LL.D. New York: D. Appleton & Co., 1908. 2 vols. 12mo.; cloth; 414-444 pages; 21 illustrations. Price, $5.

The last twenty-one years of Herbert Spencer's life, following after the close of his autobiography, appears in this important publication. For this period, it is the only authoritative record. The value is significant when it is known that a part includes material that Spencer at the time thought best not to use himself. By this plan, the Life and Letters gains the insertion of the "Filiation of Ideas," written by him in 1899. It is the philosopher's final contribution to the theory of evolution and furnishes a concise elucidation of the Synthetic Philosophy. The space devoted to the letters shows an able selection of correspondence with representative literary and scientific persons; and the high narrative level attained in the portion given to the life in no respect falls short in the work of nicely and strongly carrying the portrayal through the difficulties of a long biography. Five portraits are presented of Spencer between 19 and 78 years of age. The index is very comprehensive.

MANUAL OF ROAD CONSTRUCTION AND MAINTENANCE. By Major E. M. Paul, R.E. Chatham, England: Published by the Royal Engineers' Institute, 1908.

This work was compiled at the School of Military Engineering by Major Paul, R.E., of the instructional staff of the School of Military Engineering at Chatham. It is a valuable contribution to civil as well as military engineering, although it was intended primarily for the military engineer.

DYNAMO-ELECTRIC MACHINERY. By Francis B. Crocker, E.M., Ph.D. Chicago: American School of Correspondence, 1908. 8vo.; pp. 235. Price, $1.50.

The title page tells that this is an authoritative treatise on the theory of constructive details, calculations, characteristic curves and design of dynamo-electric machinery. The author is the head of the department of electrical engineering of Columbia University, past president of the American Institute of Electrical Engineers, and is the author of a number of books on electricity. He is a recognized leader in his profession. The present work will prove of special value to the student as a textbook. We are particularly impressed with the clarity of the writing. The book is profusely illustrated with half-tones, line cuts, and drawings made to scale.

CURVES FOR CALCULATIONS. A Manual for Engineers, Architects, Designers, Draftsmen, Builders, and Contractors. By Sidney Diamant, E.E., Structural Engineer. New York: McGraw Publishing Company, 1908. Small 4to.; pp. 13; 25 plates. Price, $2.

This subject is a most important one to the engineer who has to deal with beams and channels for constructional work. With the aid of this book the work of the engineer will be greatly lightened.

INDEX OF INVENTIONS

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Classified Advertisements

Advertising in this column is 75 cents a line. No less than four nor more than ten lines accepted. Count seven words to the line. All orders must be accompanied by a remittance. Further information sent on request.

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. There is no charge for this service. **In every case it is necessary to give the number of the inquiry.** Where manufacturers do not respond promptly the inquiry may be repeated.

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WEBB'S "HINGE JOINT" BELT HOOKS.—No tool required. Are beaten into belt with a hammer. Send $1.00 for 500 hooks. Makes 6 feet in width of belt. Webb Hinge Belt Hook Co., Boonton, New Jersey.

Inquiry No. 8611.—Wanted to buy springs for light power purposes.

WANTED.—Good hardware patent to manuf. Royalty or purchase outright. Fine opportunity for man having good patent. Useful Appliance Co., Waterbury, Conn.

Inquiry No. 8628.—Wanted to buy paving block machines for use with partly fluid substances.

PATENTS FOR SALE.

CHEAP FOR CASH.—Grob's folding fire hose bridge. Patent No. 886,798. Patented May 5, 1908. For full particulars address Robert C. Grob, 446 Wabasha Street, St. Paul, Minn.

Inquiry No. 8650.—Wanted to buy file cutting machinery.

FOR SALE.—Either outright or on royalty, Patent No. 893,799, patented July 21, 1908, a wrench, turns by the handle. For particulars apply to J. Haugland, 655 Fifty-fourth Street, Brooklyn, N. Y.

Inquiry No. 8667.—Wanted to buy needle, pin and pen machinery.

FOR SALE.—Patent No. 884,795 for improvement in horse detachers. For full information address Robert Coates, 449 N St., N. W., Washington, D. C.

Inquiry No. 8685.—Wanted to buy 1½ to 2-inch No. 13 to 18 tempered spring steel.

HELP WANTED.

WANTED.—Man, about 35 years of age, of mechanical ability and experience, as mechanical supt. for large manufacturing plant in New England. Must be successful in managing help. Manufacturer, Box 773, N. Y.

Inquiry No. 8687.—Wanted to buy motor plows.

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Inquiry No. 8691.—Wanted to buy for export to British Guiana alcohol motors.

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COMPLETE LISTS of manufacturers in all lines supplied at short notice at moderate rates. Small and special lists compiled to order at various prices. Estimates should be obtained in advance. Address A. A. H., Box 773, New York.

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Inquiry No. 8710.—For machinery for carding, spinning and weaving jute.

Inquiry No. 8716.—For manufacturers of flower garden and light frame tools for cultivating, etc.

Inquiry No. 8719.—For manufacturers of safes.

Inquiry No. 8721.—Wanted unwelded tubing that is used for structural work.

Inquiry No. 8726.—For parties who make "Yankee Metal Polish."

Inquiry No. 8728.—Wanted the address of The Frear Novelty Co.

Inquiry No. 8735.—For parties making a still for the purpose of extracting alcohol from saw-dust.

Inquiry No. 8736.—For manufacturers of machinery for making matches, also machinery for making purses and hand bags.

Inquiry No. 8737.—For manufacturers of machinery for making tooth-brushes, shaving brushes, galvanized water buckets, locks, nibs and holders.

Inquiry No. 8738.—For parties manufacturing casein cement.

Inquiry No. 8742.—For manufacturers of water still, also of thermometer tubing.

Inquiry No. 8745.—For manufacturers of hoops such as used as toys, varying in diameter from 2⅛ to 4 feet, cross section approximating ¼x½ inch, the ends being lapped and tacked.

Inquiry No. 8746.—For dealers in paper and cardboard making machines.

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Inquiry No. 8749.—For makers of very large springs, used for running machinery.

Inquiry No. 8751.—For manufacturers of brass, tea, dessert and table spoons for silver plating.

Inquiry No. 8752.—For manufacturers of paper mill machinery for the manufacture of strawboard and wrapping paper.

Inquiry No. 8757.—Wanted address of the manufacturer of "The Index Incandescent Kerosene Burner."

Inquiry No. 8759.—For a firm to do porcelain enameling of ventilator tops, such as used on the outside of arc lamps.

Inquiry No. 8761.—Wanted to buy a small carriage propelled by electricity so that a lame person may get about by himself.

Inquiry No. 8765.—For manufacturers of insulating paper linings used in metal covers of electric snap switches; also makers of insulating papers and tools.

Inquiry No. 8766.—For parties making pressed paper goods.

Inquiry No. 8769.—For manufacturers of an appliance to attach to the old style razor blade to make same a safety razor.

Inquiry No. 8770.—For parties who make short link twist chains, links from ⅛ inch up.

Inquiry No. 8771.—Wanted to buy tune sheets for Criterion music boxes.

Inquiry No. 8772.—For a machine to make paper bottles for holding milk.

Inquiry No. 8774.—For machinery for making bags from sisal hemp.

Inquiry No. 8775.—Wanted to buy stock novelty or jewelry catalogues.

Inquiry No. 8778.—For manufacturers of reapers, binders and mowers.

Inquiry No. 8779.—For parties manufacturing gas, gasoline, steam engines and boilers; also packing and mineral wool, steam supplies, iron and lead pipe, power transmission machinery and steam fitters' tools.

Inquiry No. 8780.—For parties who make gasoline stoves.

Inquiry No. 8781.—For manufacturers of bass and snare drum shells and hoops.

Inquiry No. 8782.—For manufacturers of Chinese wood drums, tom toms and cymbals.

Inquiry No. 8783.—For manufacturers of small drummer's traps as whistles, rattles, rooster crows, etc.

Inquiry No. 8784.—For manufacturers of alcohol burners for lights and stoves.

Inquiry No. 8786.—For parties to manufacture glass balls blown about 1½ inch in diameter with a ⅛ inch hole through the center, should hold about 200 pounds to the square inch of steam pressure.

Inquiry No. 8787.—For parties who manufacture cat-gut.

Inquiry No. 8788.—For manufacturers of music rolls for self playing pianos and organs; also spring motors for same.

Inquiry No. 8790.—For the manufacturer of "Brooks improved hand pump."

Inquiry No. 8792.—For a firm that manufactures glass holders made of glass.

Inquiry No. 8794.—For manufacturers of the "Ideal Dust Pan."

Inquiry No. 8795.—For a mechanical device for catching or destroying flies, mosquitos, etc.; also traps for catching snakes.

Inquiry No. 8796.—For concerns manufacturing stills adapted to the manufacture of denatured alcohol.

Inquiry No. 8797.—For manufacturers of fiber.

Inquiry No. 8798.—For manufacturers of micro lens used in small articles such as pencils, charms, etc.

Inquiry No. 8799.—Wanted to buy new or second-hand box nailing machine for small packing cases.

Inquiry No. 8800.—Wanted complete data in regard to pegamoid.

Inquiry No. 8802.—Wanted to buy machinery for cutting and polishing oilstones, whitestones or grindstones.

Inquiry No. 8803.—For manufacturers of files, screws, druggists' supplies, hardware in general, and agricultural machinery.

Inquiry No. 8804.—For parties dealing in windmills, wood split pulleys, wheelbarrows, cutlery and picks.

Inquiry No. 8805.—Wanted to buy outfits and supplies for brazing.

Inquiry No. 8806.—For manufacturers of drawing materials.

Inquiry No. 8807.—For dealers in second-hand cotton machinery.

Inquiry No. 8808.—For manufacturers of machinery for making bungs for barrels.

Inquiry No. 8809.—For the manufacturers of metalized flowers used for hat pins, etc.

Inquiry No. 8810.—For makers or importers of porous water bottles or jars to cool drinking water by evaporation.

Inquiry No. 8811.—Wanted to buy electric tattooing needles, inks and stencils.

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Inquiry No. 8817.—For a firm that forms small articles of wire, also a firm to make wooden rings about 3 or 4 inches in diameter.

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Inquiry No. 8819.—For manufacturers of Excelsior Welding Compound.

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Inquiry No. 8821.—Wanted to buy machinery for making a rough composition board, something like a straw board.

Inquiry No. 8822.—For manufacturers of dredging machinery to be operated by gas engine.

Inquiry No. 8823.—For manufacturers of crepe paper and paper novelties.

Inquiry No. 8824.—For a firm to design and build an automatic machine for making finger shields.

Inquiry No. 8825.—For manufacturers of a new device to split wood.

Inquiry No. 8826.—Wanted to buy small fuel compression machines both manual and engine power.

Inquiry No. 8827.—For manufacturers of annealed glass.

Inquiry No. 8828.—Wanted to buy thin, highly tempered steel for safety razors.

Inquiry No. 8829.—Wanted to buy machinery for making pins, hair pins, hooks and eyes.

Inquiry No. 8830.—Wanted to buy machinery for making brushes and baskets.

Inquiry No. 8831.—Wanted to buy knitting machines.

Inquiry No. 8832.—Wanted addresses of high-grade label weavers, preferably in New York.

Inquiry No. 8833.—Wanted to buy a peanut shelling machine.

Inquiry No. 8834.—Wanted to buy a 2-horse-power gasoline engine for spray wagon working on hilly ground.

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Inquiry No. 8836.—Wanted to buy decorticating machines for sisal.

Inquiry No. 8837.—Wanted to buy folding umbrellas.

Inquiry No. 8838.—Wanted to buy metallic targets similar to clay birds used in shot-gun shooting.

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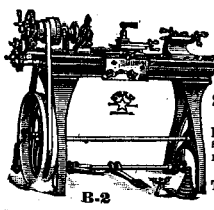

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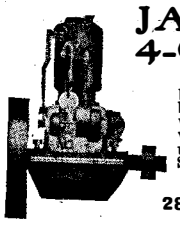

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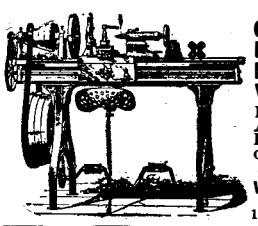

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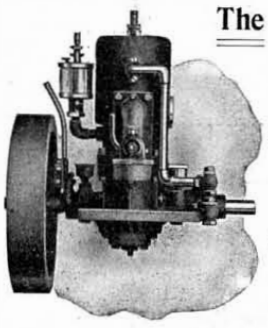

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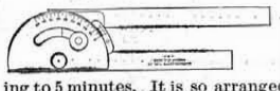

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